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A REVIEW OF THE GENERA OF THE WATER-MITES

By ROBERT H. WOLCOTT

WITH TEN PLATES

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I. Introduction

The increasing interest in the study of fresh-water biology in this country has caused a constantly growing demand for information regarding the organisms inhabiting such bodies of water. Among these forms are the water-mites or hydrachnids, sure to attract at once the attention of the observer owing to their activity and their beauty of form and color. But when the student endeavors to name any of these animals he is confronted at the start with a lack of literature. Several papers on North American water-mites have appeared but none of them are general in nature. In 1901, a German authority, Dr. Richard Piersig, published, as one part of a series of monographs entitled Das Tierreich, a monograph of the Hydrachnidae of the world; but this is inaccessible or unusable to the greater number of our amateur microscopists and students of the fresh-water fauna. Without waiting for the preparation of a monograph covering all of our species, it has been thought well to present a review of the genera, by means of which the investigator may classify his specimens thus far. For specific identification the author must refer him to published papers on several genera, references to which will be found in the bibliography (Koenike, 1895b; Marshall, 1903, 1904; Wolcott, 1899, 1900, 1901, 1902, 1903), with the assurance that reviews of other genera are being prepared, to appear in print soon.

In the preparation of this paper I have made free use of the work of Piersig, referred to above, and am glad to acknowledge my indebtedness to that authority. But since Piersig's monograph was published a number of new genera have been described and these, together with all at that time known from all parts of the world have been here included, since the distribution of these animals is so little known and in certain cases known to be so wide that it is not impossible that any one of the genera shall be taken within our limits.

Furthermore, an attempt is here made to estimate the weight of characters, to group the different genera, and to create taxonomic divisions of higher rank. I have also endeavored to fix upon a type species for each genus, believing that to be not only desirable but a necessary step if our nomenclature is to be placed on a stable basis. Piersig (1901a) indicated a certain number of types, but did not designate one for each genus. In this I have followed the International Rules of Zoological Nomenclature and the recommendations of the International Commission, of which the following, transcribed from the recent bulletin (No. 24) of the U. S. Hygienic Laboratory, by C. W. Stiles, are especially pertinent in the discussions which follow:

"ART. 29. If a genus is divided into two or more restricted genera, its valid name must be retained for one of the restricted genera.

" If a type was originally established for said genus, the generic name is retained for the restricted genus containing said type.

"ART. 30. If the original type of a genus was not indicated, the author who first subdivides the genus may apply the name of the original genus to such restricted genus or subgenus as may be judged advisable, and such assignment is not subject to subsequent change.

" In no case, however, can the name of the original genus be transferred to a group containing none of the species originally included in the genus; nor can a species be selected as type which was not originally included in the genus or which the author of the generic name doubtfully referred to it.

" RECOMMENDATION.—

"(*b*) Select as type some species which the original author studied personally, unless it can be definitely shown that he had some other species more particularly in mind.

"(*c*) If the original genus has already been divided without designation of type, the type should be restricted by elimination, namely, by successively rejecting all the species which have already been transferred to other genera; the type is then selected from the species which remain.

"(*d*) Select as type the species which is best described, or best figured, or best known."

It has been my endeavor in every case to follow these rules in letter and in spirit. In every case where there can be a question as to the choice the reasons for the selection of the type will be clearly stated.

Finally, there have been included in this paper a table of the genera which, with the figures given, will enable any student to determine to the genus any water-mite he may secure, if it belong to no genus yet undescribed.

II. CHARACTERS OF WATER-MITES

As seen in the water the hydrachnids appear at first glance like small water spiders, possessing, as they do, four pairs of legs and a pair of palpi corresponding to the pedipalps of spiders. But they can at once be referred to the mites when notice is taken of the fact that there is no trace of segmentation or of division of the body into regions.

The body is compact and usually more or less globular, ellipsoidal, or ovoidal, in some cases compressed dorso-ventrally, in others laterally, and in the males of certain species of *Arrhenurus* prolonged posteriorly.

The integument in some cases consists merely of a thin, structureless, and colorless cuticle covering the whole body. The surface of this cuticle may be smooth, raised up into papillae, granulated, or marked by fine parallel striae. Many forms possess in addition certain hard chitinous plates, varying in size and thickness in different species lying between this cuticle and the tissues beneath. These plates are not homogeneous but are pierced by numerous canals also varying in size, in their direction, and in their method of branching. These chitinous plates may be many or few in number and may cover more or less of the surface of the body; in a number of forms the body is entirely enclosed by two such plates, one dorsal the other ventral, the former usually the smaller, and the two are separated by a curved suture, open or closed, and lying all or mostly upon the dorsal surface. In certain cases there is a median longitudinal suture separating two lateral plates. There is a tendency for these plates to be developed about the openings of glands upon the surface, and, in those forms which possess a median eye, about this structure. When pigment is present it occurs in the cellular layer beneath these layers just described.

Glands are present at the surface of the body which may or may not open upon papillae and which are usually accompanied by a hair or bristle. If situated near the anal opening they may be called anal glands; occasionally a pair of such glands are placed on prominent postero-lateral papillae which cause the body to appear with lateral angles behind, and these have been termed by German writers " steissdrüsen " or rump-glands. Papillae and glands lying in front of the eyes have been termed frontal papillae and glands and prominent bristles occurring uniformly in the same position have been called antenniform bristles. Hairs or bristles anywhere on the surface of the body are usually accompanied by chitinous plates.

On the dorsal surface of the body are also seen the eyes. These may be two on each side separated by a greater or less interval, or the two may be fused; they may or may not be enclosed in a chitinous capsule. The eyes of the two sides may be close together in the median line and surrounded by an ocular plate or separated by nearly the whole width of the body. In some cases a median, " fifth " eye is present, lying in the median line between the paired eyes. The lateral eyes consist of a bulb with pigment and a lens derived from the cuticula; the anterior, usually the larger, on each side, looks forward, the posterior outward or more or less backward.

On the ventral surface are seen the epimera or coxal plates into the margin of which the legs are inserted and which serve for attachment of the leg-muscles. These are of chitin, varying in thickness, and more or less porous. Eight in number, one for each leg, they vary in size, the last pair being usually the largest; they may also be united more or less into four groups of two each, or the anterior four may be fused, producing three groups, or in many cases all are fused into one large plate covering the whole epimeral area, which in turn may even include nearly the whole ventral surface of the body. In some species an anterior lateral constriction separates the marginal portion of this epimeral plate from the rest of the body and the legs may then arise from the upper surface of this free epimeral margin.

Between the anterior two epimera is a plate which has been termed the maxillary shield because of its shape, which approaches very closely the outline of a typical shield. This plate is composed evidently of a pair of chitinous plates fused along their medial margins. It forms the ventral surface of the so-called capitulum which contains the mouth-parts,—the pharynx, the air-sacs, etc.,—and bears also the palpi. The whole capitulum projects more or less, thus forming a longer or shorter snout, which may, as in *Hydrachna,* be separated into distal and proximal portions, or the maxillary shield may be produced into a median anterior process directed straight forward or curved upward, and known as a rostrum.

The anterior portion of each lateral margin of the maxillary shield passes upwards about the lateral surface of the capitulum and forms thus a sort of box for the soft parts, which has been termed the camerostom, to which the muscles moving the adjacent structures are attached. This surrounds the mouth-opening, which may be on the ventral surface, directed downward, and seen fully from below, or ventrally on the anterior surface, directed forward, and seen only in profile from below, or even invisible from beneath if the maxillary shield is produced anteriorly, when the opening is directed more or less upward as well as forward. Through this mouth-opening project the mandibles, which vary in form and structure, being composed of either one or two segments, and either straight and sharply pointed, stiletto-like, or with the distal segment more or less curved upward. On the dorsal surface of the capitulum are the two stigmata which open into two air-tubes leading to a pair of air-sacs placed above and between the mandibles and above the pharynx, and from which usually a system of tracheal tubes runs throughout the body. In the hydrachnids parasitic on fresh-water mussels these tracheal tubes are lacking.

At the antero-lateral angles of the maxillary shield are inserted the maxillary palpi, composed of segments, which vary in proportionate length and stoutness. These segments bear variously modified hairs, spines, bristles and papillae, the distal one varying in position with reference to the one preceding it, being sometimes opposable to it and forming a sort of pincer; this fifth segment may be pointed or may bear terminal claws. The segments of the papillae are covered by a relatively thick wall of chitin.

The four pairs of legs are articulated with the corresponding epimera. They are composed of six segments which usually increase in length and decrease in stoutness from the basal outwards. They are heavily chitinized, each segment forming a chitinous tube open at the two ends. These segments bear spines, bristles, and hairs of various sizes and forms, some of them being highly modified. If these hairs are very long slender and are inserted in rows so that they lie parallel to one another and thus, moving together, may assist in swimming, they are termed swimming-hairs; if they are so modified as to assist, together with a modification of the segment which bears them, in grasping the female in pairing, they may be called grasping-hairs. In the different genera many modifications of individual segments are seen and frequently these serve to distinguish the male sex. The terminal segment may be variously modified and may end in a point and bear a terminal spine or bristle, or, as is usually the case, it may bear two movable claws. These are ordinarily sharply pointed, more or less curved, and may be broad or narrow and simple or bear one or more accessory tips, or even be pectinate, or exhibit various other modifications.

Behind the epimera, even as far removed as the posterior end of the body, or between the posterior epimera and behind the anterior, varying greatly in position in different groups, is situated the genital area. It includes a genital cleft of variable length placed longitudinally, and terminated in some cases at either end by a small transverse bar of chitin. The lips of this cleft may be soft or bear genital plates varying in form but usually lunate or reniform. Either upon these plates or imbedded directly in the surface of the body are characteristic chitinous structures known as acetabula; these are cup-like or knob-like and in rare cases are borne on longer or shorter stalk-like projections of the surface. In certain cases the genital plates with the acetabula are more or less covered by genital flaps which may be to a greater or lesser extent movable, but in some cases seem to be fixed, and may cover permanently these structures beneath them. The genital plates and flaps bear many or few spines, bristles or hairs, and in the genus *Unionicola,* which lays its eggs in the tissues of the fresh-water mussel, strong spines placed near the middle of the margins of the cleft serve as an ovipositor. In certain species the cleft lies at the bottom of a depression which has been called the seminal sac; in others the margins of the cleft are developed into a projecting petiole which differs decidedly in form and structure in different species. The penis, which may be seen projecting more or less through the genital cleft of the male may possess a chitinous framework.

Behind the genital area is seen the so-called "anal opening," which rarely communicates with the terminal portion of the intestine, but in most cases forms the opening for the Malpighian vessels. It may possess an anal plate of chitin or a pair of anal flaps.

The color of hydrachnids varies greatly but is frequently either red or else some shade of bluish green. From above or beneath blackish, brownish, or greenish spots are seen which vary in size and intensity and are due to the stomach and its blind diverticula seen through other more superficial structures. A whitish, yellowish, or reddish Y-shaped dorsal mark or markings of various form seen on the dorsal, lateral, or posterior surfaces, are due to the presence of excretory matter in the so-called Malpighian vessels, and thus may disappear altogether. The color of water-mites is very variable and the same species may at the same locality and at the same time be red or of different shades of green or bluish green.

The hydrachnids are small forms usually from 1 mm. to 2.5 mm. long, rarely exceeding a length of 5 mm., but on the other hand, in the adult condition, rarely measuring less than 0.5 mm.

The sexes are separate, sexual dimorphism being a common phenomenon, and all species lay eggs. These are deposited singly or in mass, imbedded in a greater or less amount of a gelatinous matrix, on water plants or other submerged objects, or in masses between the gills of fresh-water mussels, or singly in the tissues of the mussel. The embryo undergoes considerable development before escaping from the egg membranes, at which time it becomes an active six-legged larva. The larva may live for a time free in the water, but, after a short free existence, become a parasite either on aquatic insects which remain habitually in the water or on insects which leave the water and become aerial, or, on the other hand, it may not become free but remain in the mantle or gills of the mollusk in which the eggs were laid, only leaving one mussel to migrate to another.

After this stage is passed the larva pupates either on the animal on which it was parasitic or in the tissues of the mollusk, or else fastens itself to a water plant and there undergoes pupation. From the quiescent pupa is later disclosed an eight-footed form which has been called a nymph and also a sub-imago while the stage has moreover been designated as the second larval stage. In this stage the mite has legs and palpi frequently quite similar to those of the adult but the epimera are not so large and the genital field is lacking in the structures which distinguish the adult. During this time the mite is not parasitic except in the case of the mussel parasites. Another, the second, pupal stage must intervene before the appearance of the adult but this stage is passed through rapidly and except in the same mussel parasites is frequently passed while the animal is attached to aquatic plants. Instances have been described in which the nymph was produced directly from the eggs in the egg-mass.

The hydrachnids are in all stages carnivorous, the free-living forms feeding upon crustacea, insect larvae, protozoa, etc., in fact any aquatic form which they can overpower. Thus they are most abundant in those bodies of water, rich in vegetation, which support the most abundant animal life. They are found at all seasons and in waters of different temperatures, but are most abundant in the cool clear waters of spring-fed lakes, full of plant life, in the latter part of the summer and early in the autumn. Some are found only in cold mountain lakes, others only in warm swampy ponds at lower altitudes. Some are pelagic, but most of them live in the vegetation on the bottom or along the margin of the water.

Most of them are fresh-water forms but a very few have been described which are marine and a few other forms have accustomed themselves in certain localities to life in brackish water.

Hydrachnids are generally distributed over the world but none have so far been described from Australia. At present about seventy genera are known.

In descriptions it is convenient to adopt certain conventional forms of reference. The palpal segments may be numbered from the base outward and known as palp. 1, palp. 2, etc.; the epimera may be numbered from before backward, ep. I, ep. II, etc.; the legs may bear corresponding Roman numerals and the segments be numbered from the base outward, using Arabic numerals, any leg being known as leg I, leg II, etc., and any segment being designated as leg. seg. I 1, leg. seg. III 4, leg. seg. IV 6, etc. The palpi possess an upper or extensor surface, a lower or flexor, an inner or medial, an outer or lateral; the legs the same extensor or flexor surfaces but instead of medial and lateral, anterior and posterior or pre-axial and post-axial.

III. Weight of Characters in Classification

The writer has in a previous paper (1901) briefly discussed the classification of the Hydracarina and advanced, among others, the following propositions:

1. The tribe Hydracarina is polyphyletic in origin, as evidenced by the wide difference between the larval types.
2. The uniformity of conditions under which the species exist has led to a great similarity of structure between the adults of the different species.
3. The characters of the mite in its early stages reveal more of the phylogenetic relationships than do those of the adult.
4. On the other hand, owing to this uniformity of conditions the forms are unusually conservative, and the structural characters presented by the adult may in consequence be accepted as possessing a maximum value in classification.

The acceptance of these propositions, however, is of little value in assisting us to arrive at a satisfactory grouping of the forms under consideration.

Our knowledge of the larval characters is, at the present time, so incomplete that conclusions based on such evidence must be very uncertain, while the evidence afforded by the characters of the adult is very contradictory. In many instances two forms agree closely in the character of certain structures, but judged by the appearance of other structures should fall in widely different groups. Evidently some species have retained the primitive character of certain parts though other parts have become much modified; while other species, on the contrary, possess the former structures in a modified form and the latter have been but little changed. Or we may presume that we are witnessing in the various different combinations of characters which the genera exhibit the play of numerous variation tendencies working out together. Only a complete knowledge of the larval stages will enable us to better estimate the relationships of the larger groups or the significance of all this agreement and lack of agreement in the smaller.

In spite of the contradictory evidence thus presented, however, it is possible to arrive at an approximate estimate of the relative importance of the different characters possessed by the various parts of the body. Indeed, a study of the literature reveals a certain amount of agreement as to what characters shall be used in the defining of genera and what in the distinction of species, although many authors in defining a new genus and species either make no clear distinction between characters belonging to the genus and those of the species, or else enumerate the characters of the one and ascribe to the other the same characters. I do not wish to suggest a belief in the fixity of any group of animal forms. Nature has set no boundaries; classification is purely an artificial device. But being artificial, and not natural, we are justified in using it as an instrument and making of it as perfect an instrument as possible. The most successful classification is that which is found, as the science progresses, to require the least change necessary to adapt it to new discoveries. And that can be devised only by attaching a certain weight, it may be in some cases rather arbitrarily, to each of the different characters which the animals possess, and by the general acceptance of these values by the workers with each group.

But no classification can be acceptable which does not represent the consensus of opinion of all such workers, and that can be secured only through the expression of individual opinions and a gradual sifting process. This paper is presented as such a contribution. It can represent but the opinion of the writer and yet care has been taken to make the suggestions accord so far as possible with present usage as determined by a careful study of different authorities, in the hope that they may be accepted by other students with the minimum amount of change.

Returning to the structure of the water-mites it is natural to begin by considering the body as a whole, and here, as all through this discussion, the characters which belong to mites as an order will be assumed. The tribe Hydracarina is distinguished by the compactness of the body and the absence of any transverse sutures which might cause it to appear as if divided into regions, as well as the absence of the very conspicuous striation which is seen in such mites as the sarcoptids.

As family characters may be assigned the consistency of the body and permanence of form, the Limnocharidae being highly variable as compared with other families; and also any marked tendency to a certain character of the surface, either smooth or papillated (or provided with chitinous plates), which is shared by the forms included. The possession of prominent glands, or of a characteristic form, number and arrangement of chitinous plates, shared by the several species of a genus, and a characteristic body form also common to all the species, are characters which seem to merit recognition as of generic rank. The presence or absence of chitinous plates is a character of no more than specific importance.

The presence of two lateral eyes which may be more or less fused is a character shared by all water-mites. Their position, median or lateral, and their inclusion in a chitinous capsule, are family characters, and a general tendency in any family toward fusion of the two or toward the presence of a median eye may be added. The actual separation or fusion of the lateral eyes and the presence or absence of the median eye have been generally recognized as generic characters.

All hydrachnids possess a capitulum such as is described above, mandibles fitted for piercing, and mouth-parts adapted for sucking the juices from their prey. The degree to which this capitulum is projected to form a snout and the number of segments of the mandibles, however, differ in different families. Only very marked peculiarities in the size and form of the snout or rostrum and mandibles are apparently generic characters. The Hydracarina possess two stigmata situated far forward on the capitulum, and a system of tracheal tubes which are only absent in one genus, which has adapted itself to parasitic life within the tissues of its host.

The water-mites have in all cases five-segmented palpi. They differ greatly in different genera but certain family resemblances and tendencies may be traced in the characters of the palpus as a whole, while different genera present characteristic modifications of the individual segments.

The presence of epimera or coxal plates is a character shared by all water-mites, but the general size in comparison with the total area of the ventral surface is a character in which the families differ. Genera seem to be characterized by the comparative size of different epimera, the general relation they bear to each other and their grouping, the tendency they show to fuse together, and characters, such as the characteristic outline of certain epimera and the place of attachment of the legs, which are common to all the species.

The legs are six-segmented in this group and are terminated by claws without the disks which are present in the gamasids and other mites. There seem to be no characters of the legs which distinguish one family from another, as families are here defined, but genera are characterized by the absence of claws on leg IV, by the presence or absence of swimming-hairs, and of peculiarly modified segments, and in certain cases by a noteworthy lengthening or thickening of the legs or by the presence of peculiar spines.

The presence or absence of swimming-hairs is a character the usefulness of which has been diminished by a lack of agreement as to the application of the term. It has even been applied to long hairs on the body. I should restrict the term to very long hairs borne at the distal end of leg segments, placed in a row lengthwise of the segment and extended parallel to one another in such a way that in the movement of the legs they may, acting passively together, aid in swimming. Thus defined, the presence of swimming-hairs goes along with a certain habit of life and almost invariably with other characters of generic importance.

The genital area is almost invariably provided in the water-mites with characteristic acetabula, usually situated upon genital plates and the absence of both plates and acetabula is a family character while different genera show the absence of either one or the other. As generic characters may be enumerated the position with respect to the epimera, the general form, and the presence or absence of genital flaps. The presence of such peculiar structures as the petiole or stalked actabula or of modified spines serving in oviposition should also be added. The actual number of actabula is apparently only a specific distinction as a rule.

With the exception of a few species of oribatids or horny mites and certain halacarids or marine mites the Hydracarina alone are found in fresh water; they are also characterized by a brilliancy of coloring not attained by any other mites, by the complicated metaphosis briefly described above, and by the characters of the immature stages. The latter are of the highest value in determining phylogenetic relationships and, so far as they are known, of great importance in defining families and subfamilies, and even genera, but at the present time our knowledge in this regard is so imperfect that such data must be used with caution.

The following table will assist in obtaining a clear picture from the suggestions just made:

TABLE OF FAMILY AND GENERIC CHARACTERS

	FAMILY	GENERIC
Body	General consistency, involving permanence of form Character of surface (if common)	Characteristic form Character of chitinous covering Presence of prominent glands or other cutaneous structures Character of surface
Eyes	Position of lateral eyes Presence of a chitinous eye-capsule Presence of an eye-plate Tendency of lateral eyes to fuse (if common) Presence of a median eye (if common)	Separation or fusion of lateral eyes Presence of a median eye
Capitulum	Tendency to develop a snout (if common) Number of segments of mandible	Marked peculiarities in size and form of rostrum or snout Marked peculiarities in characters of mandible Presence of an ancoral process
Palpi	Characteristic modifications of the palpus as a whole (especially if common)	Characteristic modifications of individual segments General proportions of the palpus as a whole and relative length and thickness of segments
Epimera	Size of epimera as compared to area of ventral surface	Grouping and relation to each other Comparative size and marked peculiarity of form Tendency to fusion Place of attachment of legs
Legs		Absence of claws on leg IV Presence of swimming-hairs Peculiar modifications of certain segments Characteristic spines Marked peculiarities in length and stoutness
Genital area	Absence of genital plates and acetabula	Absence of genital plates or acetabula Position with reference to epimera Presence of genital flaps Number of acetabula Marked peculiarities as presence of a petiole, of spines serving as an ovipositor, of peculiar acetabula, etc.

Sexual dimorphism	Common characters	Common characters
Larva	General character of capitulum and of palpi	Less marked peculiarities of same nature
	Position of mouth-opening	Finer details of structure
	Size and relationship of epimera in general	
	Presence of a dorsal plate	
	Number of segments of legs	
	Characters of terminal claws on legs	
Nymph	Characters corresponding in general to those of the adult	Characters corresponding in general to those of the adult

NOTE.—Subfamilies, as the author has conceived them, are simply groups of genera which agree in certain characters otherwise of only generic value. It seems unwise, at least in the present state of our knowledge, to attempt to introduce characters of subfamily rank between those of family and genus. *This table is to be applied, subject to the principles which follow.*

Before leaving this matter I wish to call attention to certain principles which it seems to me it is important to recognize in this connection:

(1) A character ordinarily of such value as to assist in the definition of a taxonomic division of any given rank, may, if it be strongly emphasized, if it be shared by a number of members belonging to that rank, and if it exhibit no gradation from the condition seen in these to that existing in the other members, become a character of a value corresponding to the next higher rank. Such characters are the length of legs in *Hydrochoreutes* and the peculiar modifications of the spines of the legs of *Neumania.*

(2) Conversely, any character, ordinarily of a given taxonomic value, must be considered as reduced in value if it stand alone unsupported by evidence derived from other characters, or if, even though it receive weak support from other characters, it shows a gradual gradation into a different character. The presence of swimming-hairs ordinarily goes along with other characters of generic importance but in *Lebertia* some species possess them while others do not, yet all agree so closely in all other respects that it seems unwise to break up the genus on this ground alone. The same is true of *Unionicola.*

(3) A relatively higher value is to be placed on characters exhibited by more simple forms than on those possessed by the more

highly differentiated, at least so far as the discrimination of genera and species is concerned.

(4) The weight to be attached to any character will necessarily vary as the number of known forms in any group increases and as those already known become studied with greater care and exactness. Stability of classification in any given group can not be expected until all the forms in that group become known, and then will still be a matter of opinion, and can only be achieved by the exercise of the right of the majority.

The writer would urge finally that in the description of new genera a clear statement should be made concerning each character which seems of generic importance. Personally I would like to see all new genera rejected the proposal of which is not accompanied by a formal generic diagnosis. To propose a genus and simply name a type species, for example, without giving any generic characters is manifestly unfair since it is an attempt to secure credit for the genus while forcing some one else to assume the labor of formulating a generic diagnosis and defining its limits.

IV. Grouping of the Water-mites

In a paper above referred to (1901), the author summed up the previous efforts at a grouping of these forms in the following paragraphs:

Even in the writings of very early writers is observable a tendency to partition the genera of water-mites, then few in number, between groups of higher rank, and Leach (1815) in 1815 recognized two families; the Eylaides with one genus, *Eylais,* and the Hydrachnides with two genera, *Hydrachna* and *Limnochares.* Koch (1837), in 1842, included under the order Acari, Section 1 or Water Mites, containing forms with movable swimming-hairs, two families, Hygrobatides and Hydrachnides. To the former, characterized by the possession of two eyes, he assigned the genera *Atax, Nesaea, Piona, Hygrobates, Hydrochoreutes, Arrenurus, Atractides, Acercus, Diplodontus* and *Marica;* to the latter, characterized by the presence of four eyes, *Limnesia, Hydrachna, Hydryphantes, Hydrodroma* and *Eylais.* Under Section 2, or Swamp Mites, containing forms with a prominent snout, he included *Limnochares, Thyas, Smaris* and *Alycus,* of which neither of the last two have been again grouped with the water-mites until Nordenskiöld's proposed arrangement, given hereafter. Kramer (1877) divided the hydrachnids into four families: Hydrachnidae, with mandibles one-jointed, lancet-shaped (type *Hydrachna*); Eylaidae, with mandibles dwarfed and consisting of two hooklets (type *Eylais*); Hygrobatidae, with mandibles distinctly two-jointed, the distal claw-like (types *Nesaea* and *Arrenurus*); and Limnocharidae, with mandibles and labrum fused forming a firm capitulum (type *Limnochares*).

Haller (1881a) gave to the "Hydrachnidae" the rank of a suborder and recognized two families on the basis of the position of the eyes; Medioculatae, including *Limnochares* and *Eylais*, and Lateroculatae, including all the other genera. In 1891 Canestrini (1891) raised the "Hydracarini" to the rank of an order, and included under it three families—Halacaridae, Limnocharidae and Hydrachnidae. The first, or marine mites, are by most authorities separated entirely from the water-mites, while of the two other families the former is equivalent to Haller's Medioculatae, and the latter to his Lateroculatae.

Thus the matter of systematic arrangement stood, when in a later paper Kramer (1893) by distinguishing clearly between three principal types of larvae, and making this the basis of his arrangement of the genera, proposed the following, which seems to the writer the first logical classification:

Order Prostigmata—
    Fam. 1—Hydrachnidae (larval type I).
    Fam. 2—Hygrobatidae (larval type II).
    Fam. 3—Eylaidae (larval type III).
    Fam. 4—Trombididae.

Piersig (1897) in his great work on "Deutschlands Hydrachniden" reduced the Hydrachnidae to the rank of a family with five subfamilies—Limnocharinae, Hydrachninae, Eylainae, Hydryphantinae, and Hygrobatinae. Nordenskiöld (1898) later canvassed very carefully the morphological and systematic relationships of the Hydrachnidae and came to the conclusion that the term Trombididae should include a number of sub-families, representing two lines of descent, to the forms included under one of which he applied the term Trombidiformes, and to the others Rhyncholophiformes. The former contains, according to him, the subfamilies Trombidinae, Hydryphantinae, and Hygrobatinae on the one hand, and Eylainae and Limnocharinae on the other; the latter the Hydrachninae, Rhyncholophinae, including the genus *Rhyncholophus,* etc., and Smaridinae, including *Smaris, Smaridia,* etc.

Sig Thor (1900) in a " Prodromus " suggested the division of the group into 14 families: Limnocharidae, Eylaidae, Hydryphantidae, Hydrachnidae, Lebertiidae, Sperchonidae, Limnesiidae, Hygrobatidae, Pionidae, Curvipedidae, Atacidae, Brachypodidae, Aturidae, Arrenuridae. The genera then recognized were assigned to the different families but no family characters were given nor any discussion of the basis on which the division was made.

Piersig in his monograph in Das Tierreich (1901a) evidently was not satisfied with any of the proposed classifications for he treated the group as a family and recognized no division. About the same time the writer (1901) proposed tentatively the following grouping:

Family 1, Hydrachnidae; family 2, Limnocharidae, including the subfamilies, (1) Limnocharinae, (2) Eylainae, and (3) Hydryphantinae; family 3, Hygrobatidae, subfamilies?

Still more recently Oudemans (1902) has divided the family Hydrachnidae into six sub-families; Limnocharinae, Eulainae, Hydryphantinae, Hydrarachninae, Hygrobatinae, and Piersigiinae; and the subfamily Hygrobatinae into three tribes, Hygrobatae, Frontipodae, and Arrhenurae.

Whether or not the group containing the water-mites be considered as a family or as a group of higher rank, the greater number of authorities seem to agree in considering it a unit, and one the division of which into smaller groups is possible and desirable. But there seems to be no agreement at all as to the exact character of this division. The following observations are offered with the hope that they may contribute a little toward such an agreement.

On the basis of the larval characters the genus *Hydrachna* seems to stand quite apart from the rest of the water-mites, and with it may be placed *Bargena* which resembles it closely in the adult condition, the larva of the latter being yet unknown. These the writer prefers to consider as forming one family, and the first of the group Hydracarina. An examination of the larvae of the other genera, so far as known, seems to show a relationship between them and it is a natural arrangement based upon the characters of the capitulum, including the palpi, the epimera and legs, to place them in this order: *Limnochares, Diplodontus, Eylais, Arrhenurus,* and *Hygrobates.* Of these may be grouped together only the last two;

the first two bear a close resemblance to the Trombididae and the third also a considerable degree of similarity.

Thus the larval characters seem to point to a division of the whole group, aside from the Hydrachnidae, into four of lesser rank which we prefer to recognize as families,—Limnocharidae, Hydryphantidae, Eylaidae, and Hygrobatidae,—and to these may be added, following Oudemans (1902), as the sixth, Piersigiidae, separated on the basis of adult characters, the larva being unknown.

The Limnocharidae including *Limnochares* and *Cyclothrix,* resemble very closely the Trombididae, as has just been said, and seem to represent a primitive condition.

The Hydryphantidae seem also primitive; a noteworthy fact is that they alone of all water-mites, have larvae with six-segmented legs. On the basis of adult characters they may be divided into two subfamilies, the Diplodontinae and Hydryphantinae. To the former of these belong the genera *Diplodontus* and *Oxopsis;* to the latter, *Thyas* and *Hydryphantes* and allied genera, which may be again grouped as follows: *Thyas, Panisus and Thyopsis* have the body broad, chitinous plates in the integument, no swimming-hairs, and genital flaps each with three knob-like acetabula; a fifth eye is present only in *Thyas. Partnunia, Protzia,* and *Sporadoporus* have the body elongated, no chitinous plates, no swimming-hairs, the epimeral groups widely separated; and stalked acetabula with or without genital flaps; a median eye is present only in *Protzia. Hydryphantes* and *Eupatra* have the body broad, no chitin except the median eye-plate of *Hydryphantes,* swimming-hairs, a median eye, and genital flaps or plates with a variable number of acetabula. *Mamersa* stands by itself, resembling *Thyas* in the character of the capitulum and palpi, *Eupatra* in the possession of swimming-hairs and in the character of the genital area; it has no median eye, and the development of chitin is carried to the extreme, the whole body being covered with chitinous plates.

The Eylaidae is a third primitive group, in the character of the adult closer to the Limnocharidae than are the Hydryphantidae, and therefore placed between the two, but in larval characters it resembles rather more the Hygrobatidae. Here belong *Eylais* and *Capeulais.*

Piersigia, the only genus included in the family Piersigiidae, is a rather anomalous genus resembling in a certain degree *Eylais* on the one hand and on the other the Hygrobatidae.

The last family, the Hygrobatidae, is by far the most numerous in genera and species and exhibits a great variety in structure. Its separation into subfamilies is difficult and a satisfactory arrangement of the forms at this time impossible, but a grouping may be suggested which will facilitate the placing of a new form and the suggestion of which may assist in some degree to a solution of the problem.

Arrhenurus and its allies may be at once set off from the other forms in this family by the character of the palpi. Thor (1900) considered them a family Arrenuridae, Oudemans (1902) a tribe Arrhenurae. None resemble to any extent the lower families but they are placed first in the present paper because of the separation of the epimera in the larva and the strong tendency to the development of a rostrum.

Resembling *Arrhenurus* very greatly in the characters of both the larva and nymph are *Midea* and *Mideopsis,* while in the adult the latter especially shows a tendency to the development of a rostrum. The palpi in the two are very different from those of *Arrhenurus* and different from one another, but the two genera are evidently closely related and represent another subfamily. With them, on the basis of the characters of the adult, it seems justifiable to group *Mamersopsis, Amasis, Torrenticola, Notomideopsis, Xystonotus,* and also *Tanaognathus* and *Koenikea,* the first of which genera in the character of the palpi looks toward the Hydryphantidae. *Brachypoda* and *Axonopsis* differ considerably from the preceding and form a second group; that they are very closely related is shown by their great similarity in all stages. With them must be grouped *Ljania* and *Albia.* The palpus of *Brachypoda* shows a curious resemblance to that of *Eylais.* The larva of *Aturus* is not known but the nymph bears a certain, though not very close, resemblance to those of the preceding forms and the adults betray evidences of a relationship. With *Aturus,* as a third group of related genera, should be grouped *Hjartdalia.* Thor (1900) put these forms in three separate families, the first group in Libertiidae, the second forming the Brachypodidae, and the latter part of the Aturidae. As has just been stated the three groups seem quite distinct in certain characters and yet in the present condition of our knowledge the writer prefers to consider them as forming one subfamily, which may be termed the Aturinae, characterized especially by the complete chitinous investment divided by a suture into two portions, dorsal and ventral. Many of these show a high degree of sexual dimorphism, which entitles them to be ranked with the higher genera.

In sharp contrast to the genera previously enumerated we now come to a subfamily which includes *Tyrrellia, Limnesia, Limnesiopsis, Pseudosperchon, Hydrovolzia, Sperchon* and *Teutonia,* and in which the surface of the body is soft, in several, however, with a tendency to the development of chitin. The primitive character of the whole group, which we shall call the Sperchoninae, is evidenced by the recurrence of such characters as a papillation of the surface, the presence of hairs on the epimera, the projection of the capitulum to form a snout, and the presence of genital flaps, all these characters looking backward toward the Hydryphantidae. *Tyrrellia* is distinctly a primitive form both in structure and habits, living, as it does, in boggy places, and clambering over the wet ground at the margin of the water. *Limnesia* has been generally recognized as primitive, and an additional evidence is the separation of the lateral eyes. *Pseudosperchon* is very similar in appearance and in many details of structure to *Thyas,* while *Hydrovolzia* shares these primitive characters. *Sperchon* has in certain cases the surface papillated and has the capitulum very movable. In none of these genera is there a marked sexual dimorphism. This subfamily includes Thor's families Limnesiidae and Sperchonidae; it may be recognized by the division of the epimera into four groups and the position of the genital area far forward, at least as far as between the posterior epimera.

The fourth subfamily is the Lebertiinae, including *Nilotonia, Lebertia, Oxus, Frontipoda* and *Gnaphiscus,* and forming part of Thor's family Lebertiidae. It is especially characterized by the union of the epimera into a single plate and by the character of the palpi. *Nilotonia* and *Lebertia* show evidences of primitive character in the occurrence of species with papillated surface and with chitinous plates, while in *Lebertia, Oxus* and *Frontipoda,* all three, the surface is frequently striate. *Nilotonia* also has a prominent rostrum, reminding one of that of *Tanaognathus* and *Koenikea,* and in *Lebertia* is observed a tendency to the development of a short snout. In all the sexes are similar. *Oxus* and *Frontipoda* possess a posterior process of the maxillary shield resembling an ancoral process, the presence of which seems to characterize the next subfamily.

The fifth subfamily, the Pioninae, shows a separation of the epimera into four groups, as in the Sperchoninae, but it is distinct in the position of the genital area, which is always behind the last epimera and even at the posterior end of the body, in the possession of an ancoral process on the maxillary shield, and in the absence of several of the primitive characters which mark that subfamily. The genera may be separated into three groups: The first includes *Unionicola* and the related genera, *Ecpolus, Encentridophorus, Neumania, Dadaya,* and *Najadicola;* of these all but *Najadicola* betray a tendency to the development of chitin, all have the last epimeron rectangular, and all have its posterior margin transverse except in *Najadicola,* where it is rounded. Of these *Ecpolus* seems to show primitive characters, in the possession of a rough surface and a snout. The second group includes *Pseudofeltria, Feltria, Huitfeldtia, Tiphys, Piona* and *Wettina;* and of these *Pseudofeltria* and *Feltria* seem to look backward to forms below. All of these but the two just named show a tendency of the last epimeron to be produced into an angle on the posterior margin and to be narrowed at the medial end so that sometimes it forms with the inner end of ep. III a common angle. The third group contains *Hydrochoreutes, Pionopsis, Laminipes, Pionides,* and *Pionacercus.* These all have the epimera large, occupying a considerable part of the ventral surface, the epimeral groups are only separated by a narrow interval, and the genital area lies in an emargination in the medial posterior angles of epp. IV and has three acetabula on each side. In nearly all the genera of this subfamily there is a very striking sexual dimorphism. In the case of two genera, *Tiphys* and *Pionacercus,* the males have the epimeral groups in contact and in the latter even tending to fuse.

The last subfamily, the Hygrobatinae, is characterized by the epimera being in three groups instead of four, and by the long, slender palpi, which resemble in some ways those of the Sperchoninae. *Atractides* contains species developing chitin in the integument and that genus, as well as *Mesobates* and *Hygrobates,* have the surface striate; *Atractides* has a short rostrum; in *Capobates* the epimera are all in contact, while in this genus, as well as in *Mesobates* and *Hygrobates,* the capitulum is fused with the anterior epimera.

The two marine genera, *Pontarachna* and *Nautarachna,* belong without doubt to the Hygrobatidae, but it is somewhat uncertain with which of the above subfamilies they should be associated. Apparently if put in any, it should be the Lebertiidae, but the writer has preferred to leave them by themselves.

V. Diagnosis of Genera and of Higher Groups

In these diagnoses, except in the first, the contracted form is used for the sake of brevity. When the form of the body is given it is the outline as seen in a dorsal view.

Tribe Hydracarina. Aquatic Acarida with a compact body, showing no trace of segmentation; with two eyes on each side usually fused to form a double eye; usually without a snout, which if present is only moderately developed; with mandibles usually two-segmented, the segments rarely fused, and fitted for piercing, the distal segment being either claw-like or ending in a sharp, stiletto-like point; with five-segmented palpi; with four pairs of epimera to each one of which is articulated a six-segmented leg, usually terminated by two claws; with a genital area usually provided with genital plates and acetabula; with a tracheal system, except in one genus where it has been lost in consequence of a parasitic habit of life, the stigmata being situated far forward, on the dorsal surface of the capitulum; frequently exhibiting sexual dimorphism; usually brilliantly colored and active; egg-laying, and passing through a complicated metamorphosis, the stages including a six-legged larva and an eight-legged nymph; living in fresh water, very rarely marine.

Family I—Hydrachnidae. Body soft, the surface usually papillated, with or without chitinous plates or even entirely covered with a chitinous investment; lateral eyes two on each side, typically enclosed in a chitinous capsule; a median eye present in *Hydrachna,* absent in *Bargena;* capitulum usually produced into more or less of a snout, at the end of which is the mouth-opening; mandible one-segmented; palpi moderate in size, tapering, the terminal segment very short, opposable with a tooth-like process on seg. 4, forming a sort of pincer; epimera relatively small; genital plates frequently fused, with numerous small acetabula; sexual dimorphism not pronounced; color some shade of red or brown.

Larva (of *Hydrachna*) (Pl. XVIII, fig. 1): Capitulum very large, movably attached to the rest of the body; palpi five-segmented, with double end-claw; mouth-opening on the under surface of the capitulum forming an almost circular sucking disk; mandibles two-segmented; epimera of the two sides separated by only a narrow space; legs five-segmented, each with a claw with two tips; dorsal surface covered with a porous chitinous plate. Living parasitically on aquatic insects.

Two genera.

Genus 1—*Hydrachna* (Müller) Latreille. (Plate XIX, figs. 12, 12a.)

Müller, 1776: 188 (name only); 1780: 615 (gen. char.). *Hydrachne* Latreille, 1796: 182. *Atax* Fabricius, 1805: 366.

Body generally circular in outline, highly arched dorsad, soft, usually papillated, or with chitinous plates, one anteriorly between the eyes most constant in its presence; lateral eyes enclosed in a chitinous capsule; median eye present; capitulum produced into a proboscis-like snout with the mouth-opening at the tip; mandible stiletto-like; epimera in four groups, gradually increasing in size from I to IV, the medial posterior angle of IV usually more or less produced; legs relatively short, the last three pairs with swimming-hairs, segs. I3, II3 and III3 shortened, claws sickle-shaped; genital opening between epp. IV, with the two genital plates: either separated from one another and lying against the medial margins of epp. IV, or in the median line and more or less grown together to form a genital shield; sexual dimorphism consisting of differences in the genital area.

Type *H. cruenta* Müller, designated by Latreille. Müller applied the name *Hydrachna* to all the numerous species of water-mites known to him and it is synonymous with the group Hydracarina as here defined (Hydrachnidae, in the broadest sense). Though in defining the genus *Hydrachna* (1780) he described at length *Hydrachna globator* (now *Arrhenurus globator*) as "une de ses nombreuses especes," he designated no type. Latreille (1796) restricted the genus to the limits since recognized by using *H. cruenta* as a type. Dugès (1834: 161) says, "L'Hydrachne géographique est celle qui a servi de type à Latreille; nons prendrons au même titre une espèce non moins répandue, *l'Acarus aquaticus globosus* de Degeer (tome vii, pl. IX, fig. 10 et 11), qui est très probablement *l'Hydrachna cruenta* de Muller, *l'Hydrachna globulus* d'Hermann (apt. VI, 10)." But *Hydrachna globosa* de Geer (=*H. globulus* Hermann) is not now generally considered the same as *H. cruenta* Müller. Müller's species has not been, without question, identified, but it is still retained here since it is not too much to hope that it may still be. In the opinion of the writer, however, as soon as it becomes evident that a type is clearly unidentifiable, another should be selected or the genus of which it is the type should be sacrificed. An unidentifiable type is as absurd, logically, as an uninterpretable rule. The identification of the species of the older European authors is something which should not be longer delayed. The number of those who are in position to speak with authority is few—it is not too much to hope that by a division of the labor in some way all the older authors' works may be canvassed and a decision reached by majority vote in regard to the identity of the forms, which decision should stand hereafter. Only those should be included in such a vote who are familiar with the fauna of the region in which the particular older author worked. In this particular case if *H. cruenta* Müller were decided to be nonidentifiable, the genus name would still stand, since Latreille did not establish, but only restricted, it; *H. geographica* Müller might be taken as the type since it was included in the genus by Latreille, but we should prefer to write *Hydrachna* (Müller) Dugés, type *H. globosa* de Geer.

Species numerous. Europe, Asia, Africa, and North and South America.

The species of this genus are becoming so numerous that it is desirable to break it up into subgenera; it would seem that the presence or absence of papillae, the presence or absence of dorsal chitinous plates, and the possession of a median unpaired plate or of two plates might furnish suitable subgeneric characters.

Genus 2—*Bargena* Koenike. (Pl. XIX, figs. 13, 13a.)

Koenike, 1893: 47.

Body with surface papillated and covered with a chitinous investment characterized by a median ventral longitudinal furrow and a dorsal circular furrow; lateral eyes separate, the posterior the larger, considerably projecting through an opening in the chitinous covering, apparently not in a capsule; no median eye; capitulum not produced to form a snout; mandibles, epimera and legs similar to those of *Hydrachna;* serrate spines on all legs; genital opening resembling that of *Hydrachna,* the plates being fused; only the ♂ known.

Type *B. mirifica* Koenike, designated by Piersig (1901a: 34).

One species. East Africa.

Family II—LIMNOCHARIDAE. Body very soft, very variable in form, papillated; lateral eyes of each side separate, those of the two sides close together in the median line, on a common chitinous plate, capsulated; no median eye; capitulum helmet-shaped, of dorsal and ventral portions, with a circular mouth-opening at the anterior end;

mandibles two-segmented, the basal segment fused with the capitulum; palpi very small, with numerous small hairs, the terminal segment deeply sunken in the preceding, and with a stout spine deeply imbedded at the tip; epimera very small, epp. III and IV slender and distant from I and II; no genital plate, the acetabula being placed free on the surface of the body; sexual dimorphism not prominent; color some shade of red.

Larva (of *Limnochares*) (Pl. XVIII, fig. 2): Capitulum moderately large, but slightly movable; palpi five-segmented, seg. 5 articulating laterally near the base of seg. 4 and forming with it a double terminal "claw"; mouth-opening at the anterior end of the capitulum; two projecting lateral double eyes; epp. I and II close together, ep. III separate from the others; legs slender, five-segmented, with numerous spines and two curved claws; integument soft, without chitinous plates. Living parasitically on water bugs of the family Hydrometridae.

Two genera.

Genus 3—*Limnochares* Latreille. (Pl. XIX, figs. 14, 14a.)

Latreille, 1796: 181. *Limnocharis* Haller, 1881a: 33.

Body soft and variable in form but in general rectangular; epimera in four groups, epp. III and IV relatively very small, being actually smaller than the anterior ones, ep. IV last-shaped and its inner end not reaching the inner end of ep. III; no swimming-hairs, but legs thickly beset with small spines; acetabula very small, numerous, arranged in rows, and imbedded in the surface of the body behind ep. IV; sexual dimorphism shown in the possession by the ♂ of a crown of hairs about the genital opening.

Type *L. aquaticus* (Linnaeus) (*Acarus aquaticus* Linnaeus), designated by Latreille.

One species described. Europe and North America.

Genus 4—*Cyclothrix*, gen. nov. (Pl. XIX, figs. 15, 15a.)

Very closely related to *Limnochares* and characters similar but differing in the oval outline of the body, in the fact that the inner end of ep. III reaches the inner end of ep. IV, in the possession of numerous swimming-hairs on legs II and III, in the larger acetabula scattered over the surface of the body posterior to ep. IV, and in the genital opening lying in a depression; the same sexual dimorphism.

Type *C. crinita* (Koenike) (*Limnochares crinitus* Koenike).

One species. Islands of Madagascar and Nossi-Bé.

The name is given in allusion to the prominent circlet of hairs about the genital opening of the ♂; it is derived from κύκλος a circle, and θρίξ, a hair.

Family III—EYLAIDAE. Body regular in outline but with soft skin, without chitin; lateral eyes two on each side, enclosed in a capsule and borne on an eye-plate, those of the two sides close together in the median line and the two eye-plates connected by a chitinous bridge; capitulum forming a short snout, the mouth-opening ventral, at the tip, circular like a suctorial disk, and surrounded by a crown of hairs; mandibles two-segmented; palpi of moderate size; epimera, small, occupying only a small part of the ventral surface; genital area without acetabula; color reddish.

Larva (of *Eylais*) (Pl. XVIII, fig. 4): Capitulum small, movable; palpi five-segmented, seg. 5 claw-like, articulated laterally at the base of seg. 4, the latter extended anteriorly into a long process, peg-like, pointed, and beset with spines; mouth-opening at the tip of the capitulum; inner ends of epp. I and II of each side fused, ep. III free; legs five-segmented, without swimming-hairs but with numerous spines and three separate large claws; two large lateral double eyes; skin soft, surface with long, feathered spines arranged in rows. Living as parasites on insects which leave the water and become aerial.

Two genera.

Genus 5—*Eylais* Latreille. (Pl. XIX, figs. 16, 16a, 16b.)

Latreille, 1796: 182. *Eulais* Agassiz, 1846: 147.

Body usually globular, rarely ellipsoidal in form, and usually smooth, though in certain species coarsely lined and granulated; palpi slender, seg. 4 longest, with last-like chitinous plates and richly supplied with hairs and spines, many of which are feathered; epimera in four groups, separated by a considerable interval and with a net-like veining, epp. III and IV slightly larger than I and II; legs I to III with swimming-hairs, IV without and allowed to trail motionless behind in swimming, all slender and exhibiting last-like plates of chitin; genital opening far forward, almost between the anterior epimera, in the ♂ surrounded by a chitinous plate bearing numerous hairs.

Type *E. extendens* (Müller) (*Hydrachna extendens* Müller), designated by Latreille.

Species numerous. Various parts of Europe, Asia, Africa, North and South America, and New Zealand.

Numerous and widely spread as are the species of *Eylais* they show a remarkable agreement in characters, which is one reason for the recognition of *Capeulais* as a separate genus. The spelling *Eylais* is accepted for the following reasons: Latreille gave no hint of the source of the name; an excellent authority on Greek to whom

I have submitted the matter can trace *Eylais* to no Greek word; therefore we are not warranted in calling it Greek and spelling it accordingly, but must accept the spelling of the original author, the derivation remaining unknown.

Genus 6—*Capeulais* Thor. (Pl. XIX, fig. 17.)

Thor, 1902: 452.

Very close to the preceding but differing in the form of the body, which is obovate in form viewed dorsally, while laterally the hinder portion of the ventral surface seems to be swollen and projects ventrad; also in the palpi, which are stout and much less abundantly supplied with spines; in the epimera, which are much larger, the two groups of each side being almost in contact; and in the very heavy posterior pair of legs.

Type *C. crassipalpis* Thor.

One species. South Africa.

For the same reason that the name of the previous genus was spelled *Eylais,* the present one is retained in the original form *Capeulais.*

Family IV—Piersigiidae. Body regular in outline, soft, with chitinous plates; two lateral eyes on each side enclosed in a chitinous capsule; capitulum hardly forming a snout, with a circular mouth-opening beneath; mandibles two-segmented; palpi of moderate size; epimera of medium size, the epimeral area covering less than one half the ventral surface; genital plates present, bearing numerous acetabula; color red.

Larva unknown.

One genus.

Genus 7—*Piersigia* Protz. (Pl. XIX, figs. 18, 18a.)

Protz, 1896b: 410.

Body with surface lined and with a sub-cuticular network of chitinous threads and numerous chitinous plates, some broad but others narrow and last-shaped, generally distributed; palpi resembling considerably those of *Eylais;* epimera approximately equal in size, in four groups, ep. IV triangular in outline, its median end not reaching the median end of ep. III; legs without swimming-hairs; genital opening between the posterior epimera, each genital plate bearing numerous acetabula collected in two areas.

Type *P. limophila* Protz, designated by Piersig (1901a: 33).

One species. Europe.

Family V—Hydryphantidae. Body regular in outline, soft, with or without chitinous plates, surface papillate; lateral eyes separate or more or less completely fused, capsulated in one of the two subfamilies, not in the other; a median eye frequently present; capitulum produced into more or less of a snout, with the mouth-opening round and at the anterior end; mandibles two-segmented; palpi varying in size from small to proportionately large, seg. 4 produced or seg. 5 articulated near the base of seg. 4, so that they appear scissor-like; epimera varying from small to moderate in size, in four groups, covering not over one half the ventral surface; genital plates present and usually also acetabula, various in character and variously placed with reference to the genital plates; color red or brownish.

Larva (Pl. XVIII, fig. 3): Capitulum rather large, constricted at the base and movably articulated with the rest of the body; palpus five-segmented, seg. 5 claw-like, seg. 4 with a spined, peg-like process at the distal end; mouth-opening cylindrical, slit above; mandibles two-segmented, with a hook-like terminal segment; epimera all separated from one another by narrow spaces; six-segmented legs without characteristic swimming-hairs, terminal segment ending in a sickle-shaped middle claw, accompanied by two curved hairs; eyes as in the adult. Leaving the water and living as parasites on aerial insects.

Thirteen genera, which may be grouped in two subfamilies, Diplodontinae with two genera, and Hydryphantinae with ten.

Subfamily 1—DIPLODONTINAE. Body surface soft; lateral eyes separate and not in a capsule; no median eye; palpi relatively small, seg. 4 proportionately very long, seg. 5 set into the side of it and opposable to it, forming a forceps-like arrangement; epimera small.

Genus 8—*Diplodontus* Dugès. (Pl. XIX, figs. 19, 19a.)

Dugès, 1834: 17, 148. *Hydrodroma* Koch, 1835, fasc. 14, figs. 7–11 (name only); 1837: 32 (gen. char.).

Body broadly oval or circular, integument soft and papillated; eyes on each side widely separated; capitulum forming a conical tapering snout; palpi relatively small, slender, the tip of seg. 4 even with that of seg. 5, both sharply pointed; epimera beset with hairs arranged in rows; legs relatively short, slender, and with swimming-hairs; genital opening rather long, behind ep. IV, with two broadly falcate plates, the two together forming an area inversely cordate in form, each plate bearing numerous acetabula; sexes alike.

Type *D. despiciens* (Müller) (*Hydrachna despiciens* Müller; synonym *D. filipes* Dugès), designated by Dugès.

Three apparently recognizable species. Europe, Asia, Africa, and North and South America.

Genus 9—*Oxopsis* Nordenskiöld. (Pl. XIX, figs. 20, 20a, 20b.)
Nordenskiöld, 1905: 3.

Body laterally compressed and with a distinct dorsal median furrow; capitulum only moderately produced; seg. 5 of palpus projecting beyond the tip of seg. 4; otherwise characters same as those of *Diplodontus.*

Type *O. diplodontoides* Nordenskiöld.

One species. Sudan (Africa).

Subfamily 2—HYDRYPHANTINAE. Body surface with a greater or less amount of chitin; lateral eyes fused and enclosed in a capsule; a median eye frequently present and often surrounded by a chitinous plate; palpi proportionately larger than in the Diplodontinae, seg. 4 of moderate length, seg. 5 set back on it, but the two not opposable; epimera relatively larger.

Genus 10—*Thyas* Koch. (Pl. XIX, figs. 21, 21a, 21b.)
Koch, 1835, fasc. 5, fig. 18 (name only); 1837: 36 (gen. char.). *Bradybates* Neuman, 1873: 409. *Zschokkea* Koenike, 1892a: 321. *Euthyas* Piersig, 1898c: 575.

Body more or less compressed dorso-ventrally, integument papillated, with a greater or less development of chitinous plates, one of which frequently surrounds the median eye, which is always present; capitulum drawn out into a snout, frequently very long, rarely truncate; palpi scissors-like at the tip; epimera abundantly supplied with hairs, ep. IV roughly triangular, leg IV being attached at the posterior lateral angle; legs richly supplied with spines, but no swimming-hairs; genital opening guarded by two movable flaps which bear each three knob-like acetabula; no sexual dimorphism.

Type *T. venusta* Koch, used by him to illustrate the genus.

Several species. Europe and North America.

The species may be arranged in three categories: those without any dorsal chitinous plates, as *T. oblonga* (*Zschokkea oblonga* Koenike); those with simply a ring about the median eye, as *T. venusta* Koch; and those with numerous, frequently large plates, as *T. thoracata* Piersig (*Euthyas* Piersig). It would not be inappropriate, in our opinion to recognize three subgenera with these species as the types.

Genus 11—*Panisus* Koenike. (Pl. XX, figs. 22, 22a, 24.)
Koenike, 1896a: 356. *Pseudothyas* Thor, 1899: 14.

Close to the preceding but differing in the absence of the median eye and in the smaller genital flaps which usually do not come in contact in the median line, but which possess a medially directed process at the posterior end; no sexual dimorphism.

Type *P. cataphractus* (Koenike) (*Thyas cataphracta* Koenike).

Species few. Europe and North America.

This genus varies, as does *Thyas,* in the character of the chitinous plates; it seems to us that *Pseudothyas* Thor is only distinguished by the form of the single chitinous plate, and therefore is not generically distinct from *Panisus* though it may be considered a subgenus, with *P. trabecula* (Thor) as the type.

Genus 12—*Thyopsis* Piersig. (Pl. XX, figs. 23, 23a.)

Piersig, 1897: 409.

Also closely related to *Thyas,* and differing in the absence of the median eye, but resembling *Thyas* in the characters of the genital area; peculiar in the size of ep. IV, which is not larger than ep. III, and in the presence of a large, thick chitinous plate, pierced by numerous polygonal openings, making it a meshwork, which entirely covers the dorsal surface; only the ♀ known.

Type *T. cancellata* (Protz) (*Thyas cancellata* Protz), designated by Piersig (1901a: 56).

One species. Germany.

Genus 13—*Partnunia* Piersig. (Pl. XX, figs. 25, 25a.)

Piersig, 1896: 52.

Body elongated in form, surface papillated, without chitinous plates; no median eye; snout short; palpi and epimera similar to those of *Thyas;* distal end of leg segs. 6 broadened, no swimming-hairs; genital opening between the posterior epimeral groups, with two genital flaps, along either lip of the opening a row of sessile circular acetabula and at the posterior end two bundles of ellipsoidal acetabula borne on long stalks.

Type *P. angusta* (Koenike) (*Thyas angusta* Koenike), designated by Piersig (1901a: 57).

One species. Switzerland.

Genus 14—*Protzia* Piersig. (Pl. XX, fig. 26.)

Piersig, 1896: 52.

Body form as in *Thyas;* integument beset with small conical papillae; median eye present; snout and palpi similar to those of *Thyas;* epimeral groups on each side separated by a wide interval; legs short, without swimming-hairs; genital field close behind the anterior epimeral groups, not reaching as far posteriad as the posterior epimera, with narrow genital plates bearing a number of stalked acetabula, the stalks gradually increasing in length from before backward; seg. 4 of palpus in the ♀ bare on the outer side, in the ♂ with five long spines.

Type *P. eximia* (Protz) (*Thyas eximia* Protz), designated by Piersig (1901a: 57).

One species. Germany.

Genus 15—*Sporadoporus* gen. nov. (Pl. XX, figs. 27, 27a.)

Similar to *Protzia* but without a median eye, with the capitulum slender and much produced, and without genital plates or flaps, but with numerous stalked acetabula borne on the surface of the body over an elongated area reaching nearly to the posterior epimera; ♂ with fewer acetabula.

Type *S. invalvaris* (Piersig) (*Protzia invalvaris* Piersig).

One species. Germany.

The name refers to the scattered genital acetabula and is derived from *σποράς*, scattered, and *πόρος*, a pore (as used in hydrachnid nomenclature, acetabulum).

Genus 16—*Hydryphantes* Koch. (Pl. XX, figs. 28, 28a.)

Koch, 1837: 30. *Hydrodroma* Neuman, 1880: 112.

Differing from *Thyas* in the possession of swimming-hairs on legs II to IV in addition to numerous shorter spines; lateral eyes close together in a capsule; median eye surrounded by a characteristic chitinous eye-plate varying in size and form, but no other chitinous plates on the dorsal surface; ep. IV largest and triangular; no sexual dimorphism.

Type *H. ruber* (de Geer) (*Acarus aquaticus ruber* de Geer). Koch (1837) included in the genus *H. cruentus* Müller, *H. puniceus* Koch, *H. hilaris* Koch, *H. plicatulus* Koch, *H. despiciens* Müller. He figured *H. hilaris* to illustrate the genus, but Piersig includes it (1901a: 69) among the unrecognized species. If we select the species first named by Koch it is *H. cruentus,* which, according to Piersig (1901a: 68), is probably *H. ruber* de Geer, as are also according to him, *H. puniceus* and *H. plicatulus.* Under the circumstances it seems that *H. ruber* is the logical type and it is here so designated, in the absence of any previous designation of type.

Species numerous. Europe, Africa and North and South America.

Here again it seems that subgenera might well be defined.

Genus 17—*Eupatra* Koenike. (Pl. XX, figs. 29, 29a.)

Koenike, 1896a: 357.

Also differing from *Thyas* in the possession of swimming-hairs; lateral eyes distant from one another but enclosed in a two-parted capsule; no eye-plate about the median eye; mandible with an unusually long and knife-like straight end segment, and a slender straight basal segment; genital opening surrounded by plates broadly lunate in form and bearing numerous small acetabula; no sexual dimorphism.

Type *E. scapularis* (Dugès) (*Diplodontus scapularis* Dugès).

Species few. Europe, E. Africa, Madagascar, Syria, Ceylon.

Genus 18—*Mamersa* Koenike. (Pl. XX, figs. 30, 30a.)
Koenike, 1898b: 372.

Chitinous plates so highly developed as to form an investment over the whole body; lateral eyes considerably separated from one another; no median eye; capitulum and palpi similar to those of *Thyas;* basal segment of mandible straight; ep. IV triangular, epp. II and III in contact and all the epimera of each side forming a continuous plate; swimming-hairs on legs III and IV, claws sickle-shaped; genital area large, lying partly between epp. IV, genital plates not movable, bearing numerous small acetabula; only the ♀ known.

Type *M. testudinata* Koenike, designated by Piersig (1901a: 70). One species. S. Africa, Madagascar.

Family VI—Hygrobatidae. Body various in form, but usually compact, surface smooth or marked with fine parallel striae, frequently with chitin in the subcuticular layer of the integument, papillated only in a few forms and those the more primitive; eyes of the two sides usually distant, those of each side usually close together and more or less fused, never enclosed in a capsule; no median eye; capitulum only in a few cases projected into more or less of a rostrum; mandible two-segmented; palpi usually with seg. 1 small, seg. 2 broadest, segs. 2 to 5 gradually decreasing in diameter, and seg. 5 articulated to the distal end of seg. 4 and projecting straight beyond it, rarely claw-like and opposable to seg. 4; epimera large, in some cases covering nearly the whole ventral surface, in four, three or two groups, or all fused into one epimeral plate; genital plates usually present and almost always acetabula, the latter cup-like or convex and slightly projecting, never knob-like or stalked, the genital area in some cases highly modified; frequently very marked sexual dimorphism; colors various.

Larva (Pl. XVIII, figs. 5–11): Capitulum large, movably articulated to the rest of the body by a narrow "neck," containing an oral groove; mandibles two-segmented with a long basal segment and a claw-like distal one; the swollen palpi with terminal claws; epimera forming a plate covering almost the whole ventral surface, separated into two symmetrical halves by a median furrow, and showing the separate epimera or not; dorsally also an undivided plate; an anal plate is almost always present; the legs bear spines and isolated swimming-hairs, the terminal segment provided with a middle principal claw and two weaker accessory claws on either side. Living generally as a parasite on various water insects, adult or immature, in one genus parasitic in the gills and mantle of fresh-water mussels.

Fifty-three genera, which, excluding two which are marine, may be divided among six subfamilies, Arrhenurinae with three, Aturinae with fifteen, Sperchoninae with seven, Lebertiinae with five, Pioninae with seventeen, and Hygrobatinae with four.

Subfamily I—ARRHENURINAE. Body entirely covered by a porous sheet of chitin, which is divided by a suture into a smaller dorsal portion and a larger ventral; a strong tendency to the development of a rostrum, which is very long in *Krendowskija;* seg. 4 of palpus with the distal flexor angle strongly produced, flattened, and forming with the movably articulated claw-like seg. 5 a sort of pincers; epimera in four groups, the anterior groups in *Arrhenurus* tending to fuse behind the capitulum.

Larva (Pl. XVIII, fig. 5) with all the epimera separate. Nymph of *Arrhenurus* (Pl. XXI, fig. 31) with the epimera as in the adult and of *Krendowskija* similar, the genital plates of the former separate except at the medial ends and bearing numerous acetabula, of the latter fused to form a triangular plate, with truncate corners, emarginate posteriorly, and possessing two acetabula on each side.

Genus 19—*Krendowskija* Piersig. (Pl. XXI, figs. 40, 40a.)

Krendowskia Piersig, 1895a: 147. *Geayia* Thor, 1897a: 11. Corr. *Krendowskija* Piersig, 1901a: 71.

Body broadly oval, the chitinous covering containing large goblet-shaped pores, dorsal suture in both sexes continuous; capitulum movable and protrusible, and rostrum produced, tapering and slightly curved upward; palpi relatively small, stout; ep. IV with a rounded posterior margin, excavate medially; legs with swimming-hairs; genital opening between the epp. IV, large, flanked by large valves each bearing three acetabula in the ♂, four in the ♀, and a row of minute hairs along the margin.

Type *K. latissima* Piersig, designated by Piersig (1901a: 71).

Three species. South Russia, Venezuela, Michigan.

Genus 20—*Arrhenurella* Ribaga. (Pl. XXI, fig. 41.)

Arrenurella Ribaga, 1902: 504. Corr. *Arrhenurella.*

Body oval, suture continuous; capitulum, palpi and legs similar to those of *Arrhenurus;* epp. II and III in contact, III separated from IV, which is quadrilateral in form, the two epp. IV being carried away from the median line, so that the two are distant from one another and the inner margin looks nearly posteriad; anterior part of genital cleft lying between the epp. IV, flanked by two immovable plates which together form an elliptical area, without acetabula; only one sex described, which one not stated.

Type *A. convexa* Ribaga.

One species. Chile.

Genus 21—*Arrhenurus* Dugès. (Pl. XXI, figs. 42, 42a, 43, 44, 45, 46.)

Arrenurus Dugès, 1834: 17, 154. Corr. *Arrhenurus* Agassiz, 1846: 34. *Anurania* Neuman, 1880: 95. *Steganapsis* Wolcott, 1901: 105, is probably an incompletely developed *Arrhenurus*.

Body variable in form, in the ♀ approximately oval, in the ♂ highly and variously modified and usually more or less produced posteriorly, forming what may be termed an appendix; the thick chitinous covering pierced by large pores, in the ♀ the suture continuous, in the ♂ open posteriorly, its two extremities passing outward to the margins of the appendix; capitulum with a wedge-shaped notch beneath the mouth-opening, closed by a membrane; palpi short, stout; the two anterior groups of epimera fused behind the capitulum, ep. IV quadrilateral, an angle on the lateral margin and a slight one on the posterior; swimming-hairs on legs II to IV, seg. IV 4 in the ♂ usually modified by the possession of a process on the flexor surface at the distal end which bears characteristic hairs; genital area of the ♀ lying a short distance behind epp. IV and including two plates next the cleft which lie in contact and form together an almost circular disk, and beyond them laterally extended, wing-like plates bearing numerous small acetabula, in the ♂ the genital area lying at the base of the appendix, with a smaller, elliptical disk and narrow lateral plates, and also this sex frequently with a copulatory organ, the petiole, and certain accessory structures.

Type *A. maculator* (Müller). Dugès enumerates as belonging to the genus, *Hydrachna cuspidator* Müller, *H. albator* Müller, and an undescribed species which he named *A. viridis,* and which, from the fact that it was figured and described to illustrate the characters of the genus, may fairly be considered the type. But this seems to be a synonym of *A. maculator* (Müller).

Species very numerous. Europe, Africa, Asia, North and South America, Melanesia.

Thon (1900) created three subgenera: *Megalurus* (Pl. XXI, fig. 44), with the appendix very long and frequently more or less broadly dilated, with no petiole or only a very small transparent projection, type *A. globator* (Müller); *Micrurus* (Pl. XXI, fig. 45), with a short wide appendix, having a deep incision at the end in which is a small petiole, type *A. forpicatus* Neuman; and *Petiolurus* (Pl. XXI, figs. 42, 42a), with the appendix short, with prominent postero-lateral angles, and a conspicuous petiole, type *A. neumani* Piersig. To these Thor (1900b) adds a fourth, *Truncaturus,* to include the forms with neither petiole nor well-defined appendix, thus approaching the females in form, type *A. knauthei* Koenike. If these are accepted the third, *Petiolurus,* containing the type of the genus, must also bear the name of the genus, instead of the one given by Thon, in accordance with the International Code of Zoological Nomenclature, Article 9, which states that "If a genus is divided into subgenera, the name of the typical subgenus must be the same as the name of the genus."

Dugès indicates the origin of the name, which is from the Greek, and so the change from *Arrenurus* to *Arrhenurus,* as the correction of an evident misspelling, is accepted.

Subfamily 2—ATURINAE. Body more or less compressed dorso-ventrally and entirely covered by chitin, or nearly so, this being in the form of a smaller dorsal portion and a larger ventral, while to these may be added smaller chitinous plates in front of and at the side of the dorsal portion; a tendency in some cases to the development of a rostrum, which in certain genera (*Mideopsis,* and especially *Tanaognathus* and *Koenikea*) becomes very long, in other cases the whole capitulum produced to form a snout (*Torrenticola*); palpi varying greatly in different genera; epimera in all cases in contact and forming with a median strip of chitin developed between the epimera of the two sides an epimeral plate, the separate epimera also showing a great tendency to fuse with one another, with this median strip, and with the ventral portion of the chitinous body covering.

Larvae of *Midea* and *Mideopsis* (Pl. XVIII, fig. 6) with the epimera separate as in *Arrhenurus,* but the body very broad and the epimeral area broad and also shortened antero-posteriorly, the capitulum being carried back beneath the anterior part of the body; larvae of *Brachypoda* (Pl. XVIII, fig. 7) and *Axonopsis* with epp. II and III of each side fused. Nymphs of the two former genera (*Mideopsis,* Pl. XXI, fig. 32) very similar to *Krendowskija* in the character of the genital area, to *Arrhenurus* in the form of the epimera; that of *Aturus* (Pl. XXI, fig. 34) with the epimera similar in certain respects but differing in their larger size and in the outline of ep. IV, while the genital area is different, the acetabula of the two sides, two on each, being widely separated; those of *Brachypoda* (Pl. XXI, fig. 33) and *Axonopsis* having the acetabula much as in *Aturus* but the epimera of each side to a considerable extent fused.

Genus 22—*Tanaognathus* Wolcott. (Pl. XXI, figs. 47, 47a.)

Wolcott, 1900: 193.

Body strongly compressed, chitinous covering a meshwork, and the suture continuous; with the rostrum produced into a long process curved gradually upward from base to tip; palpi short, tapering from base to tip, with few hairs, and with a process extending from the distal margin of seg. 4, on the outer side, parallel with seg. 5; epimera of each side in contact, those of the two sides separated by a narrow interval, ep. IV quadrilateral, with a process in the middle of the lateral margin and an angle on the posterior; legs with few swimming-hairs; genital cleft behind epp. IV, very short, without plates or flaps, but on either side numerous acetabula borne on the surface of the body; leg seg. I6 of ♂ characterized by the possession of a long, slender, straight claw.

Type *T. spinipes* Wolcott, designated by Piersig (1901a: 69).
One species. Michigan.

Genus 23—*Koenikea Wolcott.* (Pl. XXII, figs. 48, 48a, 48b.)

Wolcott, 1900: 189.

Body concave dorsally, chitinous covering thick and pierced by fine vertical pores, suture continuous; the rostrum produced in the ♀ into a long process curved strongly upward, in the ♂ slightly produced; palpi weak, seg. 2 very slender, seg. 4 with a ventral papilla; all the epimera of the ♂ fused into a single epimeral plate, those of the two sides separated in the ♀ by a narrow interval, ep. IV similar to that of *Tanaognathus;* swimming-hairs present; genital cleft flanked by two large movable valves and numerous acetabula placed directly upon the surface of the body.

Type *K. concava* Wolcott, designated by Piersig (1901a: 180).
One species. North America.

Genus 24—*Mamersopsis* Nordenskiöld. (Pl. XXII, fig. 49.)

Nordenskiöld, 1905: 7.

Body oval in form, truncate anteriorly, slightly concave above, the chitinous covering of several porous plates of different sizes, including a large one of circular form posteriorly on the dorsal surface and another large one covering the whole of the ventral surface behind the epimera and the genital area; eyes on each side separated by a strip of chitin; rostrum short; palpi ending in a short pincers; suture between epp. I and II incomplete and those of the two sides fused, while epp. III and IV of each side are completely fused and separate from II; legs proportionately short, beset with large bristles and few swimming-hairs, the last pair without terminal claws; genital area enclosed by epp. III and IV of the two sides laterally and by the ventral plate of chitin behind, and separated from all by a narrow interval, the cleft flanked by two plates, in contact, forming together an elliptical disk, no acetabula; only the ♂ described.

Type *M. thoracica* Nordenskiöld.
One species. Sudan (Africa).

Genus 25—*Torrenticola* Piersig. (Pl. XXII, figs. 50, 50a.)

Piersig, 1897d: 155. *Rusetria* Thor, 1897b: 20. *Atractides* Thor, 1899: 29.

Body oval, chitinous covering including four variously shaped, symmetrically arranged, much smaller plates at the anterior margin in addition to the two larger, dorsal and ventral, regularly present in this subfamily; capitulum produced anteriorly forming a sort of snout; palpi slenderer than leg seg. I1, with peg-like processes on the ventral side of segs. 2 and 3; epimera forming a continuous field, the two anterior completely fused, with external angles projecting forward to an unusual degree, and with the posterior end running back between the next epimera to just in front of the genital area, suture between epp. II and III obliterated, the common medial border directed nearly posteriad and forming with that of the opposite side a continuous curved line in front of the genital area, while epp. IV are more or less fused with the posterior ventral chitin; legs without swimming-hairs, claws two-pointed; genital area completely surrounded by the epimera except for a narrow interval posteriorly, with a genital flap on each side, which is slightly movable and covers in six acetabula lying in a row next the cleft, the two flaps together forming an approximately circular disk; sexes nearly alike.

Type *T. anomala* (Koch), designated by Piersig (1901a: 137). (See under *Atractides.*)

Three species. Europe, Asia, East Africa, North America.

Genus 26—*Amasis* Nordenskiöld. (Pl. XXII, fig. 51.)

Nordenskiöld, 1905: 9.

Body oval, truncate anteriorly, dorsal suture continuous, the dorsal plate with two longitudinal furrows; eyes of each side distinctly separated; capitulum not strongly projecting; distal segment of the mandible claw-like; palpi slender, ending in a short pointed terminal segment; epp. I fused and reaching back between epp. II to just in front of the genital area, epp. II, III and IV of each side, fused at their medial ends and with epp. I forming a bay in which lies the genital area; legs with swimming-hairs, the last pair without a terminal claw; genital area rectangular with rounded angles, the cleft guarded on either side by a flap covering over ten small acetabula lying next the margin; only one sex described, which one not known.

Type *A. niloticus* Nordenskiöld.

One species. Sudan (Africa).

Genus 27—*Mideopsis* Neuman. (Pl. XXII, figs. 52, 52a.)

Neuman, 1880: 67.

Body almost circular, slightly concave dorsally, suture continuous; lower margin of capitulum produced into a short rostrum; palpi short and slender, seg. 4 with two papillae on the flexor side, seg. 5 two-pointed; epimera all united and in part fused, the epimeral plate separated from the rest of the body anteriorly by a constriction, ep. IV quadrilateral, the medio-posterior angle emarginate; legs short, with swimming-hairs; genital area lying in part in the bay formed by the emarginations in epp. IV, with three acetabula on each side next the opening, outside of which are narrow, sickle-shaped flaps; no sexual dimorphism.

Type *M. orbicularis* (Müller) (*Hydrachna orbicularis* Müller; synonym *M. depressa* Neuman), designated by Piersig (1901a: 141).

Two species Europe and North America.

Genus 28—*Notomideopsis* gen. nov. (Pl. XXIII, fig. 61.)

Closely related to *Mideopsis* but differing in the form of ep. IV, the posterior margin of which is straight and transverse and the medio-posterior angle of which is not emarginate, angles of ep. I projecting, acute; in the longer legs, which are all longer than the body, and in the presence of dagger-like spines on legs I and II, set into chimney-like papillae as in *Neumania* and certain species of *Unionicola,* legs III and IV bearing swimming-hairs; and in the character of the genital area which is at a little distance posterior to the epp. IV, and possesses two broadly falcate plates, lateral of which are three small acetabula borne directly on the surface of the body; only the ♀ described.

Type *N. spinipes* (Nordenskiöld) (*Mideopsis spinipes* Nordenskiöld).

The name is compounded from νότος, the south, and *Mideopsis.*

Argentine (South America).

Genus 29—*Xystonotus* Wolcott. (Pl. XXII, figs. 53, 53a.)

Wolcott, 1900: 185.

Body elliptical, suture continuous; capitulum small, a slight tendency to the development of a rostrum; palpi short and rather stout, seg. 2 thick, seg. 4 with a long, curved, peg-like papilla at the base of the flexor surface; epimera all united, the epimeral plate separated anteriorly from the rest of the body by a constriction, ep. IV triangular and fused posteriorly with the ventral chitin of the body covering; no swimming-hairs; genital area large, pyriform, with flaps on either side covering more or less completely three acetabula; only the ♀ known.

Type *X. asper* Wolcott, designated by Piersig (1901a: 140).

One species. Michigan.

Genus 30—*Midea* Bruzelius. (Pl. XXII, figs. 54, 54a, 54b, 54c.)

Bruzelius, 1854: 35. *Asperia* Haller, 1885: 12.

Body broadly oval or nearly circular, not greatly compressed, suture continuous; capitulum similar to that of *Mideopsis;* epimera all united, ep. IV triangular, the posterior end of ep. I reaching back nearly to the genital area which lies in a bay formed by the medial ends of all the epimera; legs short, III and IV with swimming-hairs; genital area large, the cleft unusually long in the ♀, with sickle-shaped plates enclosing an elliptical space and each bearing from twelve to fifteen acetabula; in the ♂ the genital area is circular in outline and highly modified,—there is a transverse plate in front of the shortened genital cleft, the lips of which are swollen posteriorly and produced laterally into two ear-like appendages, both the posterior and lateral portions bearing numerous hairs and there being about six acetabula on the median border of the lips, in front of which are two or three acetabula on each side, while posterior to them are numerous papillae bearing hairs and structures like sucking disks, there being also scattered groups of hairs over the rest of the genital area,—and the ♂ is also distinguished by the possession of a modified leg seg. III6, which is shortened and the flexor surface of which is thickened at the base, where it bears several spines, and concave beyond, with large, weakly curved claws.

Type *M. elliptica* (Müller) (*Hydrachna elliptica* Müller), designated by Piersig (1901a: 136). The name *elliptica* has page precedence over *orbicularis* the two being synonyms.)

One species. Middle and North Europe.

Genus 31—*Brachypoda* Lebert. (Pl. XXII, figs. 55, 55a, 55b, 55c.)

Lebert, 1879: 374. *Axona* Kramer, 1875: 310 (homonym). *Brachypodopsis* Piersig, 1903: 41.

Body oval, sutures open anteriorly, each end passing downward behind the eyes on to the ventral surface and ending at the suture between epp. III and IV; palpi with a conical projection at the distal end of the ventral surface of seg. 2, seg. 4 dilated ventrad, and seg. 5 ending in three small claws; epimera completely fused at their median ends and epp. IV also fused more or less with the posterior ventral chitin; legs short, with many spines and swimming-hairs; genital area of the ♀ at the posterior end of the ventral surface, the cleft flanked by plates, each bearing three or four acetabula, that of the ♂ (of one species) removed from the posterior end and close behind the curved posterior margin of the epimeral area, with swollen plates bearing also three acetabula, but these are directed in three directions, laterad, ventrad and posteriad, and are separated by depressions; the ♂ (of the same species) is also distinguished by a modified leg IV, seg. 4 of which is curved, thickened at the base, where it bears, on the flexor surface, a broad, blunt, curved clasping spine and two shorter, slenderer spines, and with a triangular projection directed ventrad at the distal extremity where it has two sword-like spines, while seg. 5 is dilated and convex on the extensor side.

Type *B. versicolor* (Müller) (*Hydrachna versicolor* Müller; synonyms *Axona viridis* Kramer and *B. paradoxa* Lebert), designated by Piersig (1901a: 144).

Two species, of only one of which the male is known. Europe generally.

Brachypodopsis may be accepted as a subgenus but we cannot see any warrant for separating it generically from *Brachypoda.*

Genus 32—*Ljania* Thor. (Pl. XXII, figs. 56, 56a.)

Thor, 1898d: 3.

Body elliptical, chitinous covering similar to that of *Brachypoda;* eyes of the two sides separated by only a moderate interval; capitulum short; palpi slender, seg. 3 with a weak projection of the distal margin of the flexor surface; all epimera united, epp. I of the two sides completely fused, II and III of each side partially so and those of opposite sides completely, IV separated by a suture from the posterior ventral chitin and with an emargination at the medio-posterior angle, in which lies a gland opening; no swimming-hairs; genital area at the posterior margin of the ventral surface, lying in an excavation in the posterior margin of the ventral chitin of the body covering, the genital cleft guarded by two plates each bearing three acetabula; the posterior margin of the body with a cleft in the median line flanked by two projecting plates (anal flaps), and at either side two peg-like papillae; one sex described, which one not known.

Type *L. bipapillata* Thor, designated by Piersig (1901a: 145).
One species. Europe.

Genus 33—*Axonopsis* Piersig. (Pl. XXIII, figs. 57, 57a.)
Piersig, 1893: 310.

Body oval, with a chitinous covering like that of *Brachypoda* and with a median cleft in the posterior margin; palpi with seg. 2 thickened, seg. 4 with a convex flexor surface on which, beyond the middle, are two strong hairs borne on small papillae, seg. 5 pointed and ending in two small claws; epimera forming an epimeral plate, separated anteriorly by a constriction from the rest of the body, all epimera fused with each other and with the posterior ventral chitin, the anterior ends of epp. I strongly produced, extending considerably beyond the capitulum, the margins of the anterior epimera serrate and bearing hairs; legs short, II to IV with a few swimming-hairs; genital area at the posterior end of the body, including two plates each with four acetabula; no sexual dimorphism.

Type *A. complanata* (Müller) (*Hydrachna complanata* Müller; synonym *A. bicolor* Piersig), designated by Piersig (1901a: 142).
One species. Europe, North America.

Genus 34—*Albia* Thon. (Pl. XXIII, figs. 58, 58a.)
Thon, 1899: 100.

Body elliptical, truncate anteriorly, and strongly compressed; palpi short, moderately thick, segs. 2 and 3 granulated on the flexor surface, seg. 4 with two fine long hairs on the same surface; epimera all united and all fused except the two anterior which, though fused with each other, are separated from the rest by a suture, IV very large, reaching nearly to the posterior end of the body and along the posterior margin in front of the genital area fused with the ventral body chitin; legs short, II to IV bearing swimming-hairs; genital area in the same position as in *Axonopsis*, the opening large, the plates triangular with numerous moderately large acetabula; ♀ only described.

Type *A. stationis* Thon, designated by Piersig (1901a: 143).
One species. Bohemia, Michigan and Wisconsin.

Genus 35—*Aturus* Kramer. (Pl. XXIII, figs. 59, 59a, 59b.)
Kramer, 1875: 309.

Body of the ♀ inverted oval, of ♂ with a projecting anterior margin and weakly concave lateral margins, both sexes with a median cleft in the posterior margin, dorsal and ventral plates nearly equal in size; eyes of the two sides only moderately distant from each other; capitulum similar to that of *Axonopsis* and palpi also showing considerable resemblance, though seg. 2 has a long peg-like process at the distal margin of the flexor surface; epimera very similar to those of *Axonopsis* with only the fused epp. II and III of each side separate from the rest; legs short, without swimming-hairs; genital area at the posterior margin of the ventral chitinous plate, acetabula numerous, scattered along the posterior margin of the body almost to the place of articulation of leg IV and accompanied by a row of hairs, the opening guarded by two plates; the ♂ marked also by the very strongly developed leg IV, of which segs. 4, 5 and 6 are variously modified, and by the possession in certain species of club-shaped hairs at the posterior end of the body on either side of the genital opening.

Type *A. scaber* Kramer, designated by Piersig (1901a: 132).
Four species. Germany, Norway, Canada.

Genus 36—*Hjartdalia* Thor. (Pl. XXIII, figs. 61, 61a.)
Thor, 1901a: 673. *Aturellus* Piersig, 1901c: 18.

Similar to the preceding genus, but with the body oval in form and a space between the dorsal and ventral chitinous plates posteriorly; capitulum large, forming a short rostrum, projecting anteriorly; palpi with seg. 2 very heavy, seg. 4 long and slender, the former with one conical papilla on the flexor surface in the ♂ and two in the ♀, the latter with two hairs on the same surface, seg. 5 ending in two claws; epimera all fused and fused with the ventral plate, sutures between them only next the lateral margin; legs short, without swimming-hairs; numerous small acetabula are scattered along the posterior margin of the ventral plate as far anteriorly as the place of articulation of leg IV, but on the other hand do not reach the genital opening which lies in a median cleft in this plate; the ♂ is characterized by the difference in the palpi, by the fact that leg seg. IV4 has a long, flat, weakly curved spine in the middle of the flexor surface and a concavity beyond it, and seg. IV5 a concavity at the base, and by the fact that the small genital opening does not lie in a cleft in the margin of the ventral plate but is surrounded by it.

Type *H. runcinata* Thor.
One species. Norway, Germany, Bohemia.

Subfamily 3—Sperchoninae. Body soft but tending in several genera to develop chitin, surface frequently lined, or papillate, or beset with points; palpi with seg. 4 elongated and seg. 2 usually with a peg-like spine on the flexor surface either borne on a papilla or not; capitulum frequently tending to develop a snout; epimera in four groups; genital area far forward, even between epp. III.

Larvae of *Pseudosperchon* and *Teutonia* with ep. I separate and ep. II nearly separate from III; of *Limnesia* (Pl. XVIII, fig. 8) quite anomalous, being much elongated, broadly produced posteriorly, ep. I separate from II except for a short distance at the median end, and II separate from III to the same degree. Nymphs of all and also of *Sperchon* with epimera in four groups; genital area with two acetabula on each side, the whole area similar in *Limnesia* (Pl. XXI, fig. 35) to that of *Krendowskija,* and to that of *Mideopsis* and *Midea,* in *Pseudosperchon, Teutonia* and *Sperchon* (Pl. XXI, fig. 36) the four acetabula arranged in a compact group and flanked externally by lunate flaps.

Genus 37—*Tyrrellia* Koenike. (Pl. XXIII, figs. 62, 62a.)

Koenike, 1895b: 198.

Body almost circular, papillated, with a tendency to the development of one or two dorsal chitinous plates; chitinous structures all porous; mouth-opening at the anterior end of the capitulum in the middle of a disk-like surface, resembling the condition seen in the Hydryphantidae; palpi with seg. 2 broad and bearing in the middle of the flexor surface a chimney-like papilla, into which is set a chitinous peg as in *Limnesia,* seg. 4 slightly dilated at the tip, seg. 5 ending in a single point; epimera with only a narrow interval between II and III, the posterior groups widely diverging, epp. III and IV placed obliquely and the posterior surface of each excavated, all the epimera with numerous hairs; legs without swimming-hairs, IV articulated at the posterior medial angle of the corresponding epimeron, claws simple; genital area behind the anterior epimeral groups and between the posterior, with a broad reniform plate on each side, bearing three large oval acetabula arranged as in *Limnesia;* sexes nearly alike.

Type *T. circularis* Koenike, designated by Piersig (1901a: 192). One described species. North America.

Genus 38—*Limnesia* Koch. (Pl. XXIII, figs. 63, 63a.)

Koch, 1835, fasc. 2, fig. 19 and later (name only); 1837: 27 (gen. char.). *Atax* (Fabricius) Dugès, 1834: 145. *Campognatha* Lebert, 1874: 93.

Body oval, surface frequently finely striate, sometimes a tendency to become papillose and in certain species a chitinous meshwork developed; eyes of each side separate; palpi with seg. 2 bearing usually a chitinous peg in the middle of the flexor surface which may be set into a chimney-like papilla, seg. 4 long and slender with hairs toward the tip on the flexor surface, seg. 5 ending in two or three points; ep. IV triangular, with leg IV articulated at the posterior angle, and a gland-opening at the inner end of the medial angle which is more or less fused with the medial end of ep. III; legs III and IV with swimming-hairs, seg. IV6 ending in a sharp point and just back from the point a long spine; genital opening in a bay formed by the epp. IV, the opening guarded in front and behind by transverse chitinous bars, and flanked by two flat flaps each with three or four acetabula; genital flaps of the ♀ meeting along their inner margins, in the ♂ not.

Type *L. histrionica* (Hermann) (*Hydrachna histrionica* Hermann). Koch (1837) figured *L. fulgida* Koch to illustrate the genus making that by implication the type; but this is synonymous with *L. histrionica* (Hermann), which was also designated by Dugès as the type of his restricted genus *Atax*. (See under *Unionicola*.)

Species numerous. Europe, North, Middle and South America, East Africa, Madagascar.

Genus 39—*Limnesiopsis* Piersig. (Pl. XXIV, figs. 64, 64a.)
Piersig, 1897: 204.

Similar to the preceding but with the surface of the body beset with sharp points; with the eyes of each side widely separated; with the chitinous peg on seg. 2 of the palpus weak and not borne on a papilla; with epp. III and IV separate medially and with the gland-opening at the inner end of ep. IV on a separate piece of chitin; with legs richly spined and haired; with genital area larger than in *Limnesia*, in the ♂ the two plates in contact anteriorly and posteriorly, separate for a short space in the middle, and each bearing numerous small acetabula, in the ♀ the two plates not in contact and the middle space very much larger.

Type *L. anomala* (Koenike) (*Limnesia anomala* Koenike), designated by Piersig (1901a: 180).

One species. Canada, Michigan.

Genus 40—*Pseudosperchon* Piersig. (Pl. XXIV, figs. 65, 65a.)
Piersig, 1901a: 169. *Sperchonopsis* Piersig, 1896: 52 (homonym).

Body with antero-laterally projecting rounded angles, surface papillated, moderately arched; areas about the openings of the skin-glands projecting, wart-like, with coarsely roughened surface; all chitinous structures porous; capitulum projecting, snout-like; palpi with a long peg-like process on the flexor surface of seg. 2 toward the distal end, and one on seg. 4 near the base, seg. 5 ending in two or three small claws; ep. I projecting anteriorly, it, and to a lesser degree II and III, provided with movable hairs at the lateral ends, ep. IV almost triangular and hardly larger than the others; no swimming-hairs, claws two-ended; genital area between the two posterior groups of epimera, with three acetabula on each side in a row next the cleft, covered by movable flaps; sexes similar.

Type *P. verrucosus* (Protz) (*Sperchon verrucosus* Protz), designated by Piersig (1901a: 169).

One species. Germany.

Genus 41—*Hydrovolzia* Thor. (Pl. XXIV, figs. 66, 66a.)
Thor, 1905: 506. *Polyxo* Monti, 1905: 168 (homonym).

Body elongated, inverted oval, compressed dorso-ventrally, surface striate, with several porous chitinous plates, of which two dorsal, anterior and posterior, are the largest; capitulum strongly projecting, forming a prominent snout, maxillary shield broad and truncate posteriorly; palpi moderately large, simple in structure, seg. 4 with distal end dilated and a chitinous peg on the inner surface, seg. 5 ending in four claws; epimera relatively large, the two posterior groups distant from one another and at the two sides of the body, epp. III and IV being elongated antero-posteriorly and with their postero-lateral angles projecting beyond the sides of the body; legs short, without swimming-hairs, claws simple, characteristic spines and hairs on each side of the cleft which receives them; genital area small, just behind the anterior epimeral groups and between epp. III, with two flaps covering the two acetabula of each side, the acetabula sometimes seen through them, with hairs at each end of these flaps, which in the ♂ form a nearly circular area, in the ♀ a pyriform; posterior to the genital area two chitinous plates, the anterior enclosing the "anal" opening.

Type *H. placophora* (Monti) (*Polyxo placophora* Monti; synonym *H. halacaroides* Thor).

One species. Switzerland, Italy.

Genus 42—*Sperchon* Kramer. (Pl. XXIV, figs. 68, 68a.)
Kramer, 1877: 240.

Body oval, rarely with chitinous plates on the dorsal surface, smooth, or with papillae or small points; capitulum very movable; palpi strong, seg. 2 with a conical, sharply-pointed projection on the flexor surface, seg. 4 with two chitinous pegs placed one behind the other on the same surface; ep. IV quadrilateral, narrowed posteriorly; no swimming-hairs, legs usually with only short spines; genital area in great part between the posterior groups of epimera, similar to that of *Lebertia,* with three acetabula along each margin of the cleft and flaps covering them; sexes alike.

Type *S. squamosus* Kramer, designated by Piersig (1901a: 160).

Species numerous. Europe, Azores, North America.

Thor (1901) has erected two subgenera: *Squamosperchon,* with chitinous plate or plates or papillated, rarely finely striate, type *S. squamosus* Kramer; and *Hispidosperchon,* with the soft portions of the body provided with a subcutaneous chitinous meshwork and the surface covered with fine chitinous rods, giving it a rough, hairy appearance, type *S. hispidus* Koenike. For the former of these must be substituted the genus name, in accordance with the rule stated under *Arrhenurus.*

Genus 43—*Teutonia* Koenike. (Pl. XXIV, figs. 67, 67a.)

Koenike, 1889a: 104.

Body oval, highly arched, surface finely striate; capitulum projecting; seg. 2 of the palpi with a conical, sharply-pointed projection on the flexor surface similar to that of *Sperchon,* seg. 3 longer than 2, seg. 4 slender with numerous short fine hairs on the flexor surface, seg. 5 ending in a sharply curved tip; epp. IV quadrilateral in form with medial margins diverging, and with gland-openings at the medial anterior angles, which in the ♂ are entirely enclosed by the epimera, but in the ♀ have a channel leading to the medial border; swimming-hairs present, leg seg. IV6 ending in a sharp point, without a claw; genital area in part between epp. IV, with three acetabula on each side, one behind another, covered by movable flaps; in the ♂ a transverse strip of chitin in front of the genital cleft and the area broader posteriorly.

Type *T. primaria* Koenike, designated by Piersig (1901a: 158). Three species. Germany, Norway, England.

Subfamily 4—LEBERTIINAE. Body soft, in form oval or elongated, more or less highly arched and in some genera laterally compressed, the surface frequently papillated or striate, and in some cases a tendency to the development of chitin; palpal seg. 4 swollen, seg. 5 small; all epimera in contact, usually fused, and the epimeral plate so formed, in certain genera, broadly expanded and enclosing the body laterally; genital area nearly or quite enclosed by the epimeral plate.

Larva of *Lebertia* (Pl. XVIII, fig. 9) with body ending posteriorly in a bluntly-pointed acute projection, ep. I separate from II and III which are almost completely fused; larvae of *Oxus* and *Frontipoda* without the posterior projection and with epp. I much prolonged posteriorly, reaching nearly to the end of the epimeral area. Nymph of *Lebertia* (Pl. XXI, fig. 37) with epimera similar to those of the adult, epp. I being fused behind the maxillary shield, II, III and IV of each side partly fused, of *Frontipoda* with the epimera of each side all fused, and of *Oxus* and *Gnaphiscus* with the epimera of both sides fused into a single epimeral plate; in all the genital area lying in a posterior emargination of the epimera, with four acetabula, completely arranged, and laterad of them on each side a lunate flap.

Genus 44—*Nilotonia* Thor. (Pl. XXIV, figs. 69, 69a.)

Thor, 1905a: 806.

Body oval, arched, surface generally soft, papillated; ventral surface of the capitulum prolonged into a long rostrum, curved slightly upward; mandibles long and slender, distal segment a long, nearly straight claw; palpi moderately long and stout, seg. 5 with three claws; epp. I united behind the maxillary shield, II to IV on each side united but not completely fused, IV large and trapezoidal; legs moderately long, IV with swimming-hairs; behind ep. IV on each side a sickle-shaped chitinous plate, which extends up on the sides of the body and at its ventral end sends a long narrow process forward along the medial borders of epp. II, III and IV, separating the epimera from the genital area, and ending just behind ep. I; the genital area in the ♂ is elliptical with narrow lunate flaps on each side, three acetabula along each margin of the cleft, and a transverse strip of chitin in front of it, while behind this area is continuous with a broad heart-shaped plate of chitin; the ♀ possesses genital flaps nearly rectangular in form, and posterior to the genital cleft is also a transverse strip of chitin, the broad heart-shaped plate not being developed.

Type *N. loricata* (Nordenskiöld) (*Teutonia loricata* Nordenskiöld).

One species. Sudan (Africa).

Genus 45—*Lebertia* Neuman. (Pl. XXIV, figs. 70, 70a.)

Neuman, 1880: 68. *Pachygaster* Lebert, 1879: 371 (homonym). *Berlesia* Piersig, 1897: 20.

Body oval, soft, or integument developed into a hard, flexible, homogeneous covering, in some cases with small flecks of chitin, and usually striate, rarely papillate; capitulum developed more or less into a short snout; palpi weak, with seg. 4 swollen and seg. 5 small and ending in three small claws; epimera all united and partially fused, epp. I and II of the two sides in contact, III and IV diverging from the median line, IV nearly quadrilateral; legs with or without swimming-hairs; genital area in the bay formed by the diverging epp. III and IV of the two sides, with three acetabula on each side, usually covered by flaps; no sexual dimorphism.

Type *L. tau-insignita* (Lebert) (*Pachygaster tau-insignitus* Lebert), designated by Piersig (1901a: 146).

Species numerous. Europe, Asia, North America.

Thor has established subgenera: *Pseudolebertia* (Thor, 1897b), type *L. glabra* Thor, with the surface coarsely lined and without swimming-hairs; and *Pilolebertia* (Thor, 1900a), type *L. insignis* Neuman, with smoother surface, a porous cuticle, and with swimming-hairs. More recently (1905b) he has described a third, *Neolebertia,* type *L. fimbriata* Thor, which does not seem to the writer sufficiently distinct from *Pilolebertia* to be worthy of recognition. In accordance with rules of nomenclature already stated (under *Arrhenurus*) the name *Lebertia* and type *L. tau-insignita* (Lebert) must be substituted for *Pilolebertia.* Although as a rule the presence or absence of swimming-hairs seems to be a character of generic importance it is here offset by a close agreement of the species in all other respects and the occurrence of all gradations in number of swimming-hairs in different species, from none to many. However *Pseudolebertia* might readily be considered a distinct genus.

Genus 46—*Oxus* Kramer. (Pl. XXV, figs. 71, 71a.)

Kramer, 1877: 240. *Pseudomarica* Neuman, 1880: 70. *Pseudoxus* Thor, 1901: 18.

Body of an elongated oval form, dorso-ventrally or laterally compressed, soft, the surface in some cases striate; maxillary shield with an ancoral process; palpi very small, weaker than leg I; epimeral plate covering a large part of the ventral surface, with a more or less pronounced emargination posteriorly; legs short, inserted in a line running outward and upward on the side of the body, the tips of the individual epimera being directed forward, with numerous swimming-hairs and sabre-like spines at the distal ends of the segments, leg IV without claws; genital area close to the posterior margin of the epimeral plate and enclosed by it in proportion to the depth of the emargination in its posterior border, next the cleft three, rarely only two, acetabula in a row, more or less covered by movable lunate flaps attached outside of them; sexes nearly alike.

Type *O. quadriporus* Piersig, designated by Piersig (1901a: 153). It is to be regretted that *O. strigatus* (Müller) or *O. ovalis* (Müller), older and more widely diffused species, cannot stand as the type, but Kramer included only one species when he described the genus, *O. oblongus,* and this name has been changed by Piersig, since Koch had previously described *Marica oblonga* (according to Piersig = *O. strigatus*).

Species numerous. Europe, East Africa, Ceylon, Bismarck Archipelago, North America.

Pseudoxus Thor was based almost solely on the fact that the posterior emargination in the epimeral plate was practically absent. But an examination of the described species of *Oxus* shows a series of intermediate stages, from *O. ovalis* (Müller) and *O. strigatus* (Müller), in which the epimeral plate extends posteriorly on either side to nearly even with the posterior margin of the genital area, though *O. quadriporus* Piersig, in which the genital area is half enclosed, *O. tenuisetus* Piersig, *O. dahli* Piersig, and *O. ceylonicus* Daday, to *O. integer* Thor, in which the posterior margin of the epimeral plate is almost transverse in front of the genital area. It is a question where to draw the line if *Pseudoxus* were to be accepted as a subgenus.

Genus 47—*Frontipoda* Koenike. (Pl. XXV, figs. 72, 72a.)
Koenike, 1891: 19. *Marica* Koch, 1837: 25 (homonym).

Body highly arched and laterally very strongly compressed, surface finely striate, a continuous chitinous plate, really the greatly expanded epimeral plate, covering the ventral surface and also each lateral surface from just behind the eyes backward and leaving free only a frontal area, a median longitudinal furrow running from this backward around the posterior end of the body and forward on the ventral surface to the genital area, and a small area about the latter; eyes of the two sides close together; palpi short, seg. 5 two-pointed; epimera completely fused, the development of the epimeral plate above described carrying the points of insertion of the legs into line one above the other on the side of the body, and also nearly in line with the palpi; legs richly supplied with swimming-hairs, leg IV with a sword-shaped spine instead of a claw; the median furrow at its termination on the ventral surface broadening to enclose the genital area, which shows three acetabula in a row along the margin of the cleft, covered more or less by movable long lunate flaps; a small anal plate present; adults without marked sexual dimorphism but nymphs of the two sexes quite different.

Type *M. musculus* (Müller) (*Hydrachna musculus* Müller).
One species. Europe, North America.

Genus 48—*Gnaphiscus* Koenike.
Koenike, 1898: 267. *Gauriscus* Thor, 1899: 32.

Similar to the preceding genera, the ♂ with a dorsal median longitudinal furrow separating the two margins of an expanded epimeral plate as in *Frontipoda,* the ♀ with the epimeral plate as in *Oxus* not extending upward on the sides of the body; maxillary shield with a broad ancoral process and a projection outside of the articular socket of the palpus; legs as in *Frontipoda* in the ♂, in the ♀ as in *Oxus;* genital area in the ♂ enclosed by the epimeral plate as in *Frontipoda,* in the ♀ the posterior bay in this plate flask-shaped, open behind, the genital area only half included in it; no anal plate; sexes alike as adults, but as nymphs different.

Type *G. setosus* Koenike, designated by Piersig (1901a: 152).
One species. Europe.

Subfamily 5—PIONINAE. Body soft, in several genera showing a tendency to develop chitin in the integument, the surface usually smooth, in a few cases striate, rarely beset with points; capitulum only in a single genus developing a snout, but maxillary shield always of the typical shield shape or inverted bell-shaped, with an ancoral process; epimera in four groups, though in the males of two genera these groups are in contact; genital area always behind epp. IV and frequently carried back to the posterior end of the body; sexual dimorphism the rule and of very marked character.

Larva (Pl. XVIII, fig. 10) oval in form, in certain cases greatly elongated, but the epimeral area covering nearly the whole ventral surface, leaving only a small area in the median line at the posterior end, where is a small anal plate; ep. I separate, suture between II and III always present at the lateral margin, extending a variable distance toward the median line; hairs on either side of the anal plate sometimes borne on short papillae. Nymph (Pl. XXI, fig. 38) with epimera in four groups and similar in form to those of the adult but relatively smaller and the spaces between them wider; genital area in *Hydrochoreutes* similar to that of *Krendowskija, Mideopsis, Midea,* and *Limnesia,* in all the other genera two genital plates, meeting at their medial ends or separated by a greater or less interval, placed with their long axes transverse, longitudinal, or at any angle between, and bearing two, three, or several acetabula.

Genus 49—*Ecpolus* Koenike. (Pl. XXV, figs. 73, 73a.)
Koenike, 1898b: 368.

Body covered by a thick, rigid, porous, chitinous armor, in general form broadly oval, the dorsal surface with numerous conical projections, giving the body something the form of certain species of *Arrhenurus;* capitulum drawn out into a snout; mandible with a large distal segment; palpi small and slender, seg. 4 with a hair in the middle of the flexor surface and a chitinous peg at the tip, seg. 5 ending in three small claws; ep. IV quadrilateral, posterior margin straight, transverse; legs of medium length, II to IV with swimming-hairs, I and II, at least in one species, with spirally grooved spines, claws simple; on either side of the genital cleft lips which are smaller in the ♂ than in the ♀, with numerous small acetabula scattered over the body surface at either side or collected on lunate plates, in the ♂, in one species at least, with a number of hairs along the posterior margin of the area.

Type *E. tuberatus* Koenike, designated by Piersig (1901a: 228).
Two species. Madagascar, Great Britain.

There seems to be a subgeneric difference between the two species in the character of the gnital area.

Genus 50—*Encentridophorus* Piersig. (Pl. XXV, figs. 74, 74a.)
Piersig, 1897a: 60.

Body oval, showing a tendency to the development of a porous chitinous covering beneath the smooth cuticle; palpi rather long, thicker than leg I, seg. 4 elongated and with a prominent papilla bearing a chitinous peg and a pair of low hair-bearing papillae on its flexor surface, seg. 5 ending in two claws; epimera similar to those of *Neumania;* legs of moderate length, III and IV with swimming-hairs, seg. IV6 ending in a stout, straight, sharply pointed spine; genital cleft long, beginning immediately behind the last epimera, without plates, with a moderate number of scattered acetabula borne directly on the surface of the body; only the ♀ known.

Type *E. spinifer* (Koenike) (*Atax spinifer* Koenike), designated by Piersig (1901a: 229).

One species. East Africa.

Genus 51—*Neumania* Lebert. (Pl. XXV, figs. 75, 75a.)

Lebert, 1879: 357. *Cochleophorus* Piersig, 1894b: 216.

Body soft, with a greater or less tendency to develop chitin in the integument, surface beset with small, sharp, chitinous points, rarely smooth; palpi slenderer than leg I, usually with very small hair-bearing papillae on the flexor surface of seg. 4; ep. IV rectangular, broadest transversely; legs I and II with two rows of blunt dagger-like spines upon the flexor surface of the middle segments, these spines set laterally into chimney-like papillae and not rarely spirally grooved, leg III slightly shortened, IV usually with a greater or less number of feathered spines, claws simple; genital area at the posterior end of the body in the ♂, removed from it in the ♀, genital plates in the ♀ on either side of the long cleft usually roundish, with numerous acetabula, in the ♂ the plates broadly sickle-shaped or reniform, completely surrounding the genital opening.

Type *N. spinipes* (Müller) (*Hydrachna spinipes* Müller; synonyms, *N. nigra* Lebert and *N. alba* Lebert).

Species numerous. Europe, Africa, North and Middle America.

Genus 52—*Dadaya* nov. gen. (Pl. XXV, figs. 75A, 75Aa.)

A genus related to *Neumania* and characterized by the form of the body, which has a conical elevation of the posterior portion of the ventral surface, with its apex between the epp. IV; by the presence of a second prominent posterior projection, in part continuous with the first, upon which is borne the genital area, and which from the side resembles somewhat the appendix of *Arrhenurus;* by the presence of a hyaline, petiole-like structure projecting from the genital cleft; and by a modification of leg IV, seg. 6 of which is slender and strongly curved; there are swimming-hairs on legs III and IV, and the elongated, curved genital plates which lie at either side of the base of the projection bearing the genital area possess numerous acetabula; only one sex described.

Type *D. multipora* (Daday) (*Atax multiporus* Daday).

One species. New Guinea.

I take great pleasure in dedicating this very interesting and remarkable form to its discoverer, Dr. E. von Daday, whose numerous and most valuable contributions to our knowledge of the fresh-water fauna of Europe and Asia attest his great ability as a student and an investigator. Although clearly related to the group of genera with which it is here associated it is strikingly unlike any of the others and indeed is in many respects, quite unique.

Genus 53—*Najadicola* Piersig. (Pl. XXV, figs. 76, 76a.)

Piersig, 1897a: 60.

Body broadly oval, soft; palpi thicker than leg I and very short and stout, seg. 4 relatively short, being not longer than seg. 2, with two inconspicuous papillae and a spur at the distal end of the flexor surface and a sword-shaped spine on the inner side at the same end, seg. 5 with three claws; ep. IV with posterior angles rounded, the medial and posterior margins forming an even curve with a plate-like expansion beyond the articulation of leg IV; legs short, without swimming-hairs and with few spines, none set into papillae, claws simple; genital area close behind the epimera, the cleft in ♀ long and at a short distance on either side posteriorly a wing-like transverse plate with numerous acetabula, in the ♂ the cleft shorter and completely enclosed by the genital plates; parasitic in fresh-water mussels, laying eggs in masses between the gills, not in them.

Type *N. ingens* (Koenike) (*Atax ingens* Koenike), designated by Piersig (1901a: 230).

One species. North America.

Genus 54—*Unionicola* Haldeman. (Pl. XXV, figs. 77, 77a.)

Haldeman, 1842: 1. *Atax* (Fabricius) Koch, 1837: 8 [accepted by nearly all later writers, but not *Atax* (Fabricius) Dugès, which has priority].

Body oval or elliptical, posteriorly rounded, truncate or emarginate, rarely with more or less deposition of chitin; palpi long and stout, in the parasitic forms equalling or exceeding in thickness leg I, seg. 4 with more or less prominent hair-bearing papillae, seg. 5 usually with three claws; ep. IV large and approximately rectangular, only incompletely separated from ep. III; legs usually very stout, leg I in the free-living forms generally with movable, dagger-like spines set laterally into papillae, leg III shortened, legs III and IV in the free-swimming forms with swimming-hairs; genital area usually at the posterior margin of the body, the opening guarded by one or two plates on each side, bearing altogether ten, twelve, or numerous acetabula; the ♀ with spines on both lips of the genital opening which serve as an ovipositor; living parastic in fresh-water mussels, or free, and lacking tracheal tubes; eggs of the parasitic forms laid in the gills of the mussel.

Type *U. ypsilophorus* (Bonz) (synonym *U. oviformis* Haldeman).

As pointed out by Oudemans (1897: 249) the name Atax cannot be used for this genus; but I cannot agree with him in substituting *Atax* for *Limnesia.* The whole matter, to state all the facts bearing upon the question, may be summed up as follows: Linnaeus described *Acarus aquaticus,* at first confusing under this title all water-mites, but later applying the name apparently to a single species which we now know as *Limnochares aquaticus* (Linnaeus). In 1781, Müller described 49 species of water-mites, not including the preceding, under the generic name *Hydrachna*. Fabricius, for some reason, seems not to have recognized the validity of this genus. In 1793 he included two species, to-day still recognized as belonging to the Trombididae, *Acarus aquaticus* of Linnaeus, and 33 of Müller's species, all under *Trombidium*. In 1796 Latreille restricted *Hydrachna* by naming *H. cruenta* Müller as the type, and established *Limnochares,* type *Acarus aquaticus* Linnaeus, and *Eylais,* type *H. extendens* Müller. Fabricius seems to have overlooked Latreille's work and, since he did not recognize Müller's genus, when he came, in 1805, to separate the water-mites from *Trombidium,* under which he still included *L. aquaticus,* he made for them a new genus, *Atax*. Under this he included representatives of all the various groups into which *Hydrachna* was divided by Müller, thus making it co-extensive with that genus; it seems to me that the evidence shows conclusively that as he conceived the genus *Atax* it was synonymous with *Hydrachna* of Müller. Under *Atax* were included *H. extendens* Müller, the type of Latreille's *Eylais,* and *H. cruenta* Müller (quoted as a synonym of *H. globosa*), the type of *Hydrachna* as restricted by the same author. In 1834, Dugès restricted and defined *Atax* by making *Hydrachna histrionica* Hermann the type. It is true he said " Nons prenons ici pour types deux espèces . . . *Hydrachna histrionica* et *lutescens* d'Hermann," but he showed at once the impossibility of recognizing two types by describing first *Atax histrionicus,* and then comparing *Atax lutescens* with it, while he also showed that he considered the former as really the type by figuring it to illustrate the characters of the genus. In 1842, Koch (Koch, 1837) defined *Atax* in a different manner, figuring *A. crassipes* (Müller) to illustrate the genus, and giving to it an application which it has since retained, except for changes in limits due to the removal of other more recently established genera. At the same time he established the genus *Limnesia* which was synonymous with *Atax* as defined by Dugès.

Now it seems to the writer that if the name *Atax* is to be retained it certainly must displace *Limnesia* and be written *Atax* (Fabricius) Dugès. But it cannot, for if it be not accepted as a synonym of *Hydrachna* Müller, it still must fall since Fabricius included in it the type of Latreille's genus *Eylais,* as well as that of *Hydrachna,* though quoting the latter as a synonym.

The name *Atax* being thus invalidated, the only available one is

Unionicola, proposed by Haldeman, in 1842, for a genus including several supposedly distinct species of hydrachnids found in unios from eastern United States. Of these species, *U. oviformis* may be most appropriately considered as the type, but this, as is shown by its size, color, form, and the character of the claws, is without doubt a synonym of *U. ypsilophorus* (Bonz).

Genus 55—*Pseudofeltria* Soar. (Pl. XXVI, fig. 82.)

Soar, 1904: 105.

Similar to *Feltria* but differing in the absence of a dorsal chitinous plate; in the presence of a peg on the inner side of seg. 4 of the palpus at the distal end; and in the fact that the epimera, though in four groups, are separated by only a very narrow interval, the two epp. I being in contact behind the capitulum, while ep. IV is triangular with one side, the posterior, straight and exactly transverse with respect to the body; only the ♀ known.

Type *P. scourfieldi* Soar.

One species. Great Britain.

This is very close to *Feltria* and it is very much a question whether it should not stand simply as a subgenus.

Genus 56—*Feltria* Koenike. (Pl. XXVI, figs. 83, 83a.)

Koenike, 1892a: 323. *Kongsbergia* Thor, 1899a: 1 [probably a *Feltria* nymph, according to Piersig (1901a: 272)].

Body oval, compressed, integument striate, beneath the cuticle frequently a compact armor of cellular nature; a dorsal chitinous plate and smaller plates at the posterior margin above and upon the ventral surface; eyes small; mouth-opening carried far forward; palpi with flexor surface of seg. 4 bearing one or two hairs and seg. 5 two or three claws; epp. I not in contact behind the capitulum, ep. IV much broader along the lateral margin than along the medial, posterior margin of the same epimeron transverse; legs without swimming-hairs; genital area of unusually great extent, reaching from just behind the posterior epimera to near the posterior end of the body, where is usually a weak median emargination, genital plates broad, with numerous acetabula, in the ♂ completely surrounding the genital opening.

Type *F. minuta* Koenike, designated by Piersig (1901a: 230).

Species numerous. Mountain streams of Europe.

Genus 57—*Huitfeldtia* Thor. (Pl. XXVII, figs. 84, 84a.)

Thor, 1898b: 3.

Body oval, soft; capitulum small and ancoral process short; palpi without papillae, with an unusually long hair on the outer side of seg. 3, seg. 4 with two hairs on the ventral surface near the distal end and at the end a sharply pointed tooth; epimera and legs as in *Piona,* the former relatively small; genital area lying partly in the bay formed by epp. IV, in the ♀ with a very large opening flanked by two wide lips forming together a nearly circular area, which is bounded laterally by broad sickle-shaped plates each with about eight or ten acetabula and a few hairs; in the ♂ the genital area smaller and inverted cordate in form, the plates fused in front and behind the opening and with numerous hair-bearing papillae.

Type *H. rectipes* Thor, designated by Piersig (1901a: 243).

One species. Norway.

Genus 58—*Tiphys* Koch. (Pl. XXVII, figs. 85, 85a.)

Koch, 1835, fasc. 5, fig. 19 and later (name only). *Acercus* Koch, 1837: 23. *Forelia* Haller, 1881a: 58.

Body oval or elliptical, usually soft, but with a tendency to develop chitin; palpi similar to those of *Piona;* epp. I to III oblique and reaching considerably posteriad, ep. IV lying postero-laterally from III, the medial border reduced to an angle which, in common with the medio-posterior angle of III, is drawn out into a sharply pointed projection, while in the ♂ all the epimera are fused with a median chitinous plate; legs II to IV with swimming-hairs, leg seg. IV5 of the ♂ thickened and wedge-shaped, and IV6 bent, excavated on the extensor side, and bearing a number of short blunt spines; genital opening close behind the last epimera and in the bay formed by their posterior margins, flanked at a little distance by two elongated genital plates bearing numerous acetabula, in the ♂ the two plates fused and enclosing the smaller genital opening.

Type *T. liliaceus* (Müller) (*Hydrachna liliacea* Müller). Thor (1903) has designated as a type for this genus, which he calls *Forelia, F. cassidiformis* Haller. His position is this: *Tiphys* was first used by Koch in 1835 and the first species to which he applied the name was *T. decoratus,* =*Pionopsis lutescens* (Hermann), so *Tiphys* should replace *Pionopsis* with that species as a type. The second species under *Tiphys* was *T. ornatus,* which belongs to a different genus called later (1837) by Koch *Acercus;* this then becomes the type of that genus, which is the *Laminipes* of Piersig. The genus *Piona* of Neuman is a synonym and the name *Piona* must be erased from the list of genera unless it shall later be shown that the genus *Piona* of Koch represents an entirely different genus; *Acercus* and *Tiphys* being thus used for other genera, the only available name is *Forelia* Haller, whose type was *F. cassidiformis.* I cannot see that this argument is in line with the accepted code of nomenclature, and the correct statement of the case seems to me to be this: Koch in 1835 described and figured several species under the generic name *Tiphys,* neither characterizing the genus nor specifying a type. In 1837 he substituted *Acercus* for *Tiphys* which he thought preoccupied, but in this he was in error, as has since been shown; here he designated no type, but used *T. sagulatus,* a species not since recognized, to illustrate the genus. *T. lutescens* (Hermann) he placed in *Hygrobates.* Some of the species belonging to Koch's *Acercus* were put by Neuman (1880), under different names, in the genus *Piona,* which genus was not the *Piona* of Koch, and was later named *Laminipes* by Piersig (1901a). Neuman included also in this *Piona, P. lutescens* (Hermann) under the names *P. flavescens* and *P. lapponica.* In 1894, Piersig set off from Neuman's genus *Piona, Pionopsis,* with *P. lutescens* (Hermann) as the type. The type of *Laminipes* (*Piona* Neuman) must be chosen from among the remaining species studied by Neuman, and *L. ornatus* (Koch) may be accepted. The genus *Tiphys* (*Acercus*) having been thus restricted by the taking out of these two genera, and no type having up to this time been designated, the type must now be selected, according to Art. 30 of the International Code and in accordance with Recommendation (c), from among the remaining species which were included in the genus by Koch. The only one of these which is recognizable is *T. liliaceus* (Müller) (*T. latipes* of Koch, 1835, *Diplodontus liliaceus* and *D. latipes* of Koch, 1837).

Species numerous. Europe, North America.

Genus 59—*Piona* Koch. (Pl. XXVII, figs. 86, 86a, 86b.)

Nesaea Koch, 1835, fasc. 5, fig. 21 and later (name only); 1837: 10 (gen. char., homonym). *Piona* Koch, 1837: 13. *Curvipes* Koenike, 1891: 20.

Body oval or elliptical, soft, surface usually striate, rarely tending to develop chitin; palpi usually with two hair-bearing papillae on the flexor surface of seg. 4, rarely with more, and a papilla bearing a chitinous peg at the distal margin of the medial surface of the same segment; a prominent angle on the posterior margin of ep. IV, within which the margin is concave; legs all with swimming-hairs, III and IV modified in the ♂, seg. III6 being shortened, richly haired, and with characteristic claws, seg. IV4 shortened, thickened, excavated on the posterior side, and provided with variously modified spines; genital area close behind epp. IV, in the ♀ the long cleft flanked by two flaps which form an elliptical area, beyond which are a variable number of acetabula imbedded free in the body surface or borne on one or more plates; in the ♂ the opening small and opening into the bottom of a depression serving as a seminal cup, or into a seminal pouch, the plates larger and enclosing the opening and in some cases fused with the medio-posterior angles of epp. IV.

Type *P. fuscatus* (Hermann) (*Hydrachna fuscata* Hermann), designated by Thor (1903). This species would not have been my selection for a type, but having been proposed by Thor (1903: 68) and fulfilling the conditions imposed by the Code it must be accepted. A study of the evidence has convinced me that Piersig is probably correct in considering the species included under *Piona* by Koch as representing females of the smaller species of *Nesaea,* and so *Piona* is accepted as the name of this genus. However, neither Koenike (1901a) nor Thor (1903) accept this conclusion and both retain *Curvipes.*

Species very many. Europe, North and South America, Africa, Asia.

Genus 60—*Wettina* Piersig. (Pl. XXVII, figs. 87, 87a.)

Piersig, 1892b: 410.

Body oval, soft, surface finely striate, ancoral process wedge-shaped; palpi of moderate size, seg. 4 not much longer than 2, with a sword-like, pointed spine on the ventral surface and also a hair borne on a small papilla, seg. 5 with three claws; epp. I to III much elongated, oblique, and produced posteriorly to the posterior limit of the epimeral area, ep. IV being turned through nearly 90° and applied to the lateral margin of III, and trapezoidal in form with the postero-lateral angle rounded; legs of moderate length, swimming-hairs on II to IV, I in both sexes very much shortened with seg. 6 peculiarly bent, convex on its flexor side, and bearing an unusually large, two-pointed double claw; genital plates broadly sickle-shaped, each with three acetabula, lying laterad of an elliptical area surrounding the long genital cleft; in the ♂ these plates completely surround this area.

Type *W. macroplica* Piersig, designated by Piersig (1901a: 196). Thor (1903a) has identified this as a synonym of *Tiphys podagricus* Koch, but Piersig denies the correctness of his identification.

One species. Germany, Switzerland, England.

Genus 61—*Hydrochoreutes* Koch. (Pl. XXVI, figs. 78, 78a.)

Koch, 1835, fasc. 11, figs. 11–15 (name only); 1837: 16 (gen. char.). *Spio* Koch, 1835, fasc. 5, figs. 16, 17 (name only, homonym).

Body of the ♀ oval, of the ♂ roughly hexagonal with bluntly rounded angles, soft, surface striate; palpi very long and slender, seg. 4 longest; ep. IV largest, somewhat oblique, the medio-posterior angle excavated; legs very long and slender, swimming-hairs on III and IV, seg. III4 of the ♂ thickened, on the extensor side produced beyond the socket for articulation of the next segment, this projection and the distal end of the flexor side each bearing an unusually strong curved spine; genital area in the ♀ removed from the posterior margin of the body, in the ♂ at the margin, the three-parted petiole projecting beyond, at the sides of the genital opening lips which together form a narrow elliptical space and lateral of each a narrow plate bearing three acetabula.

Type *H. ungulatus* (Koch) (*Spio ungulatus* Koch, 1835). Figured by Koch to illustrate the genus.

Species few. Europe.

Genus 62—*Laminipes* Piersig. (Pl. XXVI, fig. 80b.)

Piersig, 1901a: 200. *Piona* Neuman, 1880: 51 (*non* Koch).

Body oval, soft, surface more or less distinctly striate; palpi of moderate length, with two more or less distinct hair-bearing papillae on the ventral side and a tooth-like process on the medial side of seg, 4 at the distal end; epimera separated by a wider space in the ♀ than in the ♂ and in the latter so increased in size as to cover nearly the whole of the ventral surface, ep. IV the largest, broadened laterally, the postero-lateral angle rounded; leg seg. IV4 of ♂ broadened, more or less flattened, and with numerous long hairs, the tip of seg. IV5 also produced, claws broadened at the base with a sharp outer and a blunt inner tooth, swimming-hairs present; genital plates in the ♀ usually sickle-shaped and lying at the lateral margins of the broad lips, in the ♂ irregularly triangular and occupying completely the median bay in the posterior margin of the epimeral field, in both sexes with three acetabula on each plate.

Type *L. ornatus* (Koch) (*Tiphys ornatus* Koch), designated by Thor (1903). (See under *Tiphys.*)

Several species. Europe.

Genus 63—*Pionopsis* Piersig. (Pl. XXVI, figs. 79, 79a.)

Piersig, 1894b: 216.

Very similar to the preceding genus but differing in the character of the modification of leg IV in the ♂, seg. 5 being bent distally with a number of two-pointed, compressed spines laterally at the distal end, all the legs being also longer than in the other genus.

Type *P. lutescens* (Hermann) (*Hydrachna lutescens* Hermann), designated by Piersig (1901a: 204). (See under *Tiphys.*)

One species. Europe.

This genus is very close to *Laminipes* and it is a serious question whether it should not be considered only a subgenus. The different species of *Laminipes,* in the strict sense, however, all agree in general in the character of the modification of leg IV, and the uniformity with which such a character recurs, in species from all parts of the world, in the genus *Piona* for example, seems to guarantee its generic value.

Genus 64—*Pionides* Thor. (Pl. XXVI, figs. 80, 80a.)

Thor, 1900: 265 (*nom. nudum*) ; 1901: 30 (gen. char.).

Also very similar to *Laminipes* and differing only in the characteristic modification of leg IV of the ♂; in this case seg. 4 alone is peculiar, being but slightly thickened, shortened, and with a strong curved, sword-like spine at the distal end on the extensor side.

Type *P. ensifer* (Koenike) (*Piona ensifera* Koenike), designated by Thor (1901: 30).

One species. Europe.

This genus stands on precisely the same footing as *Pionopsis.*

Genus 65—*Pionacercus* Piersig. (Pl. XXVI, figs. 81, 81a.)
Piersig, 1894: 213.

Body oval, soft, but in certain cases with a tendency to the production of chitinous plates in the integument; palpi moderate in size, thicker than leg I, with seg. 5 ending in three claws; epimera of the ♂ all more or less fused, forming an epimeral plate similar in form to the epimeral area of the two preceding genera, of the ♀ in separate groups resembling in form those of *Piona;* leg IV with swimming-hairs and, as in *Tiphys,* with segs. 4 and 5 thickened, richly supplied with spines and hairs, and with seg. 6 curved and beset with thorns; genital opening of the ♀ with wide lips, forming an elliptical area, at the lateral margins of which posteriorly are irregularly three- or four-sided genital plates bearing each three acetabula; in the ♂ the plates nearly surround the opening and fill the median emargination in the epimeral plate.

Type *P. leuckarti* Piersig, designated by Piersig (1901a: 197).

Several species. Europe.

Subfamily 6—HYGROBATINAE. Body surface soft, striated, or rarely tending to form chitin; with palpi relatively slender and seg. 4 elongated, resembling thus those of the Sperchoninae; with epimera usually in three groups, in one genus all in contact, epp. I tending to fuse with the capitulum, and therefore no ancoral process.

Larva (Pl. XVIII, fig. 11) showing a complete fusion of the epimera of each side, and possessing also a large anal plate, and two long posterior spines borne on chimney-like papillae. Nymph (Pl. XXI, fig. 39) with epimera similar to those of the adult and with two genital plates, quite separate from one another and each bearing two acetabula.

Genus 66—*Capobates* Thor. (Pl. XXVII, figs. 88, 88a.)
Thor, 1898a: 3.

Body oval, soft; capitulum fused with epp. I; palpi thicker than leg I, seg. 2 with a peg-like process on the flexor surface at the distal end, seg. 4 with two hairs on the flexor surface beyond the middle; epimera covering most of the ventral surface of the body, IV very large, quadrilateral, resembling somewhat that of *Unionicola;* legs very long, without swimming-hairs but with single long spines, leg II the shortest; genital area in the ♂ at the posterior end of the ventral surface, the plates surrounding the opening, each with three acetabula and numerous hair-bearing papillae; ♀ unknown.

Type *C. sarsi* Thor, designated by Piersig (1901a: 185).

One species. South Africa.

Genus 67—*Atractides* Koch. (Pl. XXVII, figs. 89, 89a.)

Koch, 1835, fasc. 11, fig. 16 and others (name only). Koch, 1837: 22 (gen. char.). *Megapus* Neuman, 1880: 63.

Body oval or elliptical in form, soft, surface striate or with a flexible or hard finely porous covering; capitulum not fused with the epp. I, but in close contact with them and no ancoral process present, a slight tendency to the development of a rostrum; palpi as thick or thinner than leg I, seg. 3 longer than seg. 2, seg. 4 with two hairs on the ventral surface, one behind the other, and a sword-like spine on the inner side; epp. I to III obliquely placed, IV triangular, truncate posteriorly; legs with swimming-hairs, I longer than II and with seg. 5 thickened and seg. 6 shortened and bent ventrad, both with characteristic hairs and spines; genital area removed both from the epimera and from the posterior margin of the body, cleft long in the ♀, surrounded by an oval space, postero-laterad of which are small plates, each with three acetabula; in the ♂ these plates are larger and completely enclose the smaller genital cleft.

Type *A. spinipes* Koch. Koch's genus *Atractides* contained several species not related to one another; he figured *A. spinipes* to illustrate the genus and this later served also as the type of Neuman's genus *Megapus*. In no case can *A. anomalus* Koch serve as a type, for before the designation of such it had been removed to another genus; and according to Art. 30 of the Code, the type must come from the species remaining.

Several species. Europe, North America, island of Nossi-Bé.

Genus 68—*Mesobates* Thor. (Pl. XXVII, figs. 90, 90a.)

Thor, 1901a: 677.

Between *Atractides* and *Hygrobates* in characters, with body soft, finely striate; palpi resembling closely those of *Hygrobates,* but lacking the characteristic projection on seg. 2, the fine teeth on seg. 3 remaining; epimera more like those of *Hygrobates* but III and IV fused at their medial ends, the latter quadrilateral and with a spur at the medial posterior angle; legs long and slender, I modified in a manner similar to that of *Atractides;* genital field resembling *Atractides,* the plates, bearing the three acetabula, being, however, longer and nearly enclosing the genital area and with numerous hairs; ♂ not known.

Type *M. forcipatus* Thor.

One species. Norway.

Genus 69—*Hygrobates* Koch. (Pl. XXVII, figs. 91, 91a.)

Koch, 1835, fasc. 10, fig. 8 and later (name only); 1837: 14 (gen. char.). *Rivobates* Thor, 1897: 39.

Body elliptical or broadly oval, soft, surface in some cases facetted or striate; capitulum fused with epp. I; palpi usually with a conical projection on the flexor surface of seg. 2, which, as well as more or less of the whole flexor surface of seg. 3, is covered with fine teeth, seg. 4 usually with two hairs on the ventral surface, seg. 5 ending in two or three claws; epp. I fused, epp. IV truncate behind and posterior margin usually transverse; no swimming-hairs; genital area situated, as in the two preceding genera, midway between the epimeral area and the posterior end of the body, the opening guarded anteriorly and posteriorly by transverse bars of chitin and the elliptical area formed by the lips usually flanked by triangular or broadly falcate plates, each bearing three or more acetabula; in the ♂ these plates are united both in front and behind the cleft.

Type *H. longipalpis* (Hermann) (*Hydrachna longipalpis* Hermann). Koch used "*H. lutescens* (Hermann)" to illustrate the genus, but his identification of Hermann's species was wrong, and the species to which he did refer cannot be identified according to Piersig (1901a: 192). The first species enumerated in his list of species, *H. cometes,* also cannot be identified, while the next three Piersig recognizes as synonyms of *H. longipalpis* (Hermann), which has also as a synonym the species upon which Lebert based his genus *Campognatha, C. foreli.*

Species numerous. Europe, North and South America, Asia Minor.

The subgenus *Mixobates* Thor (1805e: 371), type *H. processifer* Thor, is characterized by greater obliquity of the posterior margin of ep. IV, by the lack of genital plates, and the fact that the projection on seg. 2 of the palpus is very short and the teeth on seg. 3 nearly or quite absent.

MARINE HYGROBATIDAE. Proper position uncertain. If placed in any of the subfamilies here defined, *Pontarachna* should go in Lebertiinae.

Genus 70—*Pontarachna* Philippi. (Pl. XXVII, fig. 93.)

Philippi, 1840: 191.

Body broadly oval, highly arched, soft, integument smooth; lateral eyes fused; capitulum very small; seg. 4 of the palpi the longest, seg. 5 ending in a point; epimera of each side in close contact and partly fused, epp. I elongated and those of the two sides meeting just behind the capitulum, their medial margins narrowly diverging posteriorly, the epimeral masses of the two sides still more widely separated, leaving a median bay in which lies the genital area, ep. IV irregularly quadrilateral and sending posteriad two curved spur-like processes; lips of the genital cleft forming a circular or broadly elliptical area, which in the ♀ is guarded anteriorly and posteriorly by transverse arcuate bars of chitin, in the ♂ these two bars meeting and forming a complete ring about the area, and bearing a variable number of pores and hairs; trachea lacking; colorless; marine.

Type *P. punctulum* Philippi, designated by Piersig (1901a: 270). Three species. French coast of Atlantic ocean, Mediterranean.

Genus 71—*Nautarachna* Moniez. (Pl. XXVII, fig. 92.)

Moniez, 1888: 64.

Characters of the adult unknown.

Nymph broadly oval, integument hard, thickly covered with sharp points; each lateral eye with only one lens; capitulum borne on a movable protuberance, mandible one- or two-segmented; seg. 5 of the palpus with a scissors-like tip; epimera in four groups, small; legs short, with few swimming-hairs; genital area including two transversely placed large elongated plates, each with numerous acetabula; colored, body greenish, legs bluish; marine.

Type *N. asperrima* Moniez, designated by Piersig (1901a: 269). The founding of a genus or even species on the basis of immature specimens alone the writer cannot but feel is unjustifiable; such specimens may well be described, but had better be left unnamed.

French coast of the Atlantic ocean.

VI. Key for the Determination of the Genera of the Hydracarina

The following table is based upon that of Piersig, 1901a, though in places considerably modified. Marine forms are excluded. Of course it is purely artificial and no attempt has been made to emphasize characters which might be judged to be most important or to be of the greatest value in determining the relationship of different genera.

1. Lateral eyes of the two sides close together in the median line and borne on a common eye-plate 2
   Lateral eyes of the two sides widely separated and in no case borne on a common eye-plate 5
2. Palpal seg. 5 deeply set into 4, eye-plate long and narrow (Family Limnocharidae) 3
   Palpal seg. 5 free, eye-plate broad, consisting of two lateral portions connected by a transverse middle piece (Family Eylaidae) 4
3. Without swimming-hairs .... *Limnochares,* p. 185
   With swimming-hairs .... *Cyclothrix,* p. 185

4. Palpi slender and richly provided with long spines, many of them feathered, leg IV not thickened .... *Eylais,* p. 186

Palpi stout with a moderate number of short, simple spines, leg IV much stouter than the rest .... *Capeulais,* p. 187

5. Distal extremity of palpi seg. 4 produced beyond the point of insertion of seg. 5, the two segments together resembling a pair of pincers or shears 6

Distal extremity of palpal seg. 4 slightly or not at all produced beyond the insertion of seg. 5 18

6. Mandible one-segmented, the terminal portion straight and stiletto-like (Family Hydrachnidae) 7

Mandible two-segmented, the terminal segment curved and claw-like (Family Hydryphantidae) 8

7. Body soft, with or without plates .... *Hydrachna,* p. 183

Body completely covered with a chitinous investment ...... *Bargena,* p. 184

8. Lateral eyes of each side separate and not enclosed in a capsule (Subfamily Diplodontinae) 9

Lateral eyes of each side fused and contained in a chitinous capsule (Subfamily Hydryphantinae) 10

9. Body broadly oval or circular, dorsally arched .... *Diplodontus,* p. 188

Body laterally compressed with a dorsal median furrow .... *Oxoypsis,* p. 189

10. Without swimming-hairs 11

With swimming-hairs 16

11. Body frequently with chitinous plates, with genital flaps, each bearing 3, usually knob-like, acetabula 12

Body without plates, numerous stalked acetabula with or without flaps..... 14

12. Median eye present .... *Thyas,* p. 189

Median eye not present 13

13. Body soft or with small scattered plates .... *Panisus,* p. 189

Body completely covered dorsally by a large cribriform plate. *Thyopsis,* p. 190

14. Body elongate, a moderate interval between epp. II and III, genital flaps present, bearing sessile acetabula in addition to two bundles of stalked acetabula posteriorly .... *Partnunia,* p. 190

Body broader, epp. II and III widely separated, no genital flaps 15

15. Median eye present, genital plates bearing the acetabula ...... *Protzia,* p. 190

Median eye absent, no genital plates, but acetabula borne directly on the surface of the body .... *Sporadoporus,* p. 191

16. Without a median eye, the body completely covered by chitinous plates *Mamersa,* p. 192

With a median eye, body soft 17

17. Median eye enclosed in a chitinous eye-plate, lateral eyes of each side close together .... *Hydryphantes,* p. 191

Median eye free in the body surface, lateral eyes of each side widely separated *Eupatra,* p. 191

18. Palpal seg. 5 slightly sunken in 4, with a blunt tip which bears several hairs of different length (Family Piersigiidae) .... *Piersigia,* p. 187

Papal seg. 5 entirely free, tapering, tip bearing small claws or teeth, or ending in a sharp point (Family Hygrobatidae) 19

19. Palpal seg. 5 sharply pointed, claw-like, opposable to the projecting distal flexor margin of 4, forming a sort of pincer (Subfamily ARRENURINAE) .. 20

Palpal seg. 5 not opposable to 4, but bearing at the distal end small, more or less distinct, teeth or claws 21

20. Genital area lying between epp. IV, the cleft flanked by large valves each bearing 3 or 4 acetabula ....*Krendowskija*, p. 193

Genital area lying between epp. IV, the cleft flanked by two immovable plates forming together an elliptical area, no acetabula ....*Arrhenurella*, p. 193

Genital area lying posterior to epp. IV, the cleft flanked by two plates forming together an elliptical or circular area, beyond which are laterally extended, wing-like plates with numerous acetabula ....*Arrhenurus*, p. 194

21. Epimera in both ♂ and ♀ united and more or less fused into a single epimeral plate 22

Epimera arranged in groups, in the ♀ always separate from one another, in the ♂ closer together but distinct, only in rare cases in contact or tending in slight degree to fuse 40

22. Body more or less compressed dorso-ventrally and completely enclosed in a chitinous covering divided into a smaller, elliptical or oval, dorsal plate and a larger ventral plate (Subfamily ATURINAE)............... 23

Body highly arched, in some cases laterally compressed, with no such dorsal and ventral plate (Subfamily LEBERTIINAE)......................... 35

23. Other smaller plates in addition to the dorsal and ventral mentioned above. 24

The two plates, dorsad and ventral, covering the whole surface........... 25

24. The dorsal plate small, lying posteriorly, and covering little more than half the dorsal surface, with altogether seven smaller plates anteriorly, no acetabula ....*Mamersopsis*, p. 196

The dorsal plate larger, covering the greater part of the dorsal surface, with four smaller plates along the anterior margin, several small acetabula along the margin of the genital cleft ....*Torrenticola*, p. 196

25. Rostrum prolonged and curved upward 26

Rostrum short 27

26. Palpus short, tapering from base to tip, seg. 4 produced laterally at the distal end beyond the base of 5, genital area without flaps or valves, numerous acetabula free in the body surface ....*Tanaognathus*, p. 195

Palpi weak, seg. 2 very slender, seg. 4 with a ventral papilla, genital cleft flanked by two large movable valves, and also acetabula set free in the surface .... *Koenikea*, p. 196

27. Suture between the dorsal and ventral plates continuous, completely enclosing the dorsal plate, or open posteriorly 28

Suture open anteriorly, the two ends passing around on to the ventral surface 33

28. Acetabula lying near the genital cleft, no modification of leg IV in the ♂... 29

Acetabula arranged along the posterior margin of the body, in one or more rows, running forward on either side nearly to the point of insertion of leg IV, which leg is, in the ♂, modified 32

29. Epimeron IV quadrilateral in form 30

Epimeron IV triangular 31

30. Genital area with about 10 acetabula on each side along the margin of the cleft, covered by a flap laterad of them ....*Amasis*, p. 197

Genital area with 3 acetabula on each side next the cleft, laterad of which are narrow, sickle-shaped flaps .... *Mideopsis*, p. 197

Genital area with two broad plates or flaps, one on each side, laterad of which are 3 acetabula borne directly on the surface of the body. *Notomideopsis*, p. 198

31. Genital area with 3 acetabula on each side, covered by a lateral flap, no swimming-hairs .... *Xystonotus*, p. 198

Genital area in the ♀ with a sickle-shaped plate on each side, bearing 12 to 15 acetabula, in the ♂ highly modified, swimming-hairs present. *Midea*, p. 198

32. Epimera III and IV together more or less set off from the rest of the epimeral plate by sutures, acetabula in a single or double row along the posterior margin of the ventral plate and accompanied by a row of hairs, legs segs. IV4, IV5 and even IV6, of ♂ highly modified...... *Aturus*, p. 201

Suture only between epp. I and II, acetabula scattered irregularly over the posterior portion of the ventral plate toward the margin, only leg seg. IV5 of ♂ modified, and modification very simple .... *Hjartdalia*, p. 201

33. Genital area with 3 acetabula on each side 34

Genital area with 4 acetabula on each side .... *Axonopsis*, p. 200

Genital area with numerous acetabula on each side .... *Albia*, p. 200

34. Palpus with a conical projection on the flexor surface of seg. 2, seg. 4 dilated ventrally, swimming-hairs present, leg seg. IV4 of the ♂ modified *Brachypoda*, p. 199

Palpus slender, seg. 3 with a weak projection on the flexor surface, no swimming-hairs, ♂ apparently unknown .... *Ljania*, p. 199

35. Sutures between epimera all evident, a chitinous plate on each side posterior to ep. IV extending upward on the side of the body and sending a long process forward on the ventral surface between the epimera and the genital area, rostrum prolonged and slightly curved upward. *Nilotonia*, p. 205

Sutures between epimera more or less obliterated, no such chitinous plate or rostrum 36

36. Leg IV with claws at tip, epimera only partly fused .... *Lebertia*, p. 206

Leg IV without claws at tip, ending in a sharp point, epimera completely fused 37

37. Body laterally compressed, epimeral plate extending up on the lateral surface, leaving only a median furrow 38

Body not so decidedly compressed, epimeral plate not extending upward on the lateral surface 39

38. With an anal plate .... *Frontipoda*, p. 208

Without an anal plate .... ♂ *Gnaphiscus*, p. 208

39. With a median dorsal furrow .... ♀ *Gnaphiscus*, p. 208

Without such a furrow .... *Oxus*, p. 207

40. Epimera in four groups, in the ♂ in some cases only a narrow interval between them 41

Epimera in three groups, epp. I being fused together behind the capitulum, the groups also often close together in the ♂ (Subfamily HYGROBATINAE) 64

41. Genital area usually lying far forwards, at least between epp. IV, and the epimeral groups often separated by a considerable interval, no ancoral process on the capitulum (Subfamily SPERCHONINAE).................. 42

	Genital area lying posterior to epp. IV, at most only its anterior end lying between their emarginate posterior angles, an ancoral process present (Subfamily PIONINAE)	47
42.	Genital acetabula borne on a plate, no flaps present	43
	Genital acetabula along the margin of the cleft, covered laterally by flaps	45
43.	Acetabula numerous	*Limnesiopsis,* p. 203
	Acetabula few, large	44
44.	Leg IV with terminal claws, no swimming-hairs	*Tyrrellia,* p. 202
	Leg IV ending in a point, a long hair a little back from the tip, swimming-hairs present	*Limnesia,* p. 202
45.	With swimming-hairs	*Teutonia,* p. 205
	Without swimming-hairs	46
46.	With a long papilla proximally on the flexor surface of palpal seg. 4, body soft, areas about the openings of the cutaneous glands projecting, wart-like	*Pseudosperchon,* p. 203
	With two chitinous pegs, one behind the other, set into the flexor surface of palp. seg. 4, body soft or with few chitinous plates, one of which may be large and cover nearly the whole dorsal surface	*Sperchon,* p. 204
	Palpus simple, seg. 4 with neither a papilla nor chitinous pegs, body with numerous chitinous plates of which two dorsal plates are the largest	*Hydrovolzia,* p. 204
47.	Genital area with more than 3 acetabula on each side	48
	Genital area with 3 acetabula on each side	59
48.	Posterior margin of ep. IV rounded or transverse	49
	Posterior margin of ep. IV with a prominent acute angle	57
49.	Epimeron IV rectangular or at least lateral margin no longer than the medial	50
	Epimeron IV with lateral margin longer than the medial	56
50.	With swimming-hairs	51
	Without swimming-hairs	55
51.	Body completely invested with a chitinous covering and with several prominent tuberosities	*Ecpolus,* p. 209
	Body soft, if with chitin not completely invested, no prominent tuberosities	52
52.	Palpus stouter than leg I, seg. IV6 without claws, ending in a straight spine	*Encentridophorus,* p. 209
	Palpus slenderer than leg I, seg. IV6 with claws	53
53.	Transverse diameter of ep. IV the greater, suture between epp. III and IV complete, no prominent papillae on palp. seg. 4, acetabula very numerous, only in one case as few as 12	54
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54.	Posterior ventral surface projecting ventrad, and genital area borne on a posterior projection against the base of which lie the genital plates, no feathered spines, leg seg. IV6 curved	*Dadaya,* p. 210
	No such projections, leg IV usually with feathered spines, leg seg. IV6 straight	*Neumana,* p. 210

55. Posterior margin of ep. IV rounded, genital area midway between epp. IV and the posterior end of the body, genital plates elongated transversely *Najadicola*, p. 211

    Posterior margin of ep. IV straight, genital area at the posterior end of the body, genital plates not elongated transversely *Unionicola* (parasitic spp.), p. 211

56. No chitinous plates, a peg on the medial side of palp. seg. 4 at the distal end *Pseudofeltria*, p. 213

    A number of chitinous plates, no peg on palp. seg. 4 ....*Feltria*, p. 213

57. Medial margin of ep. IV reduced to merely a medial angle which forms a common angle with the medio-posterior angle of ep. III, leg segs. IV5 and IV6 of ♂ modified ....*Tiphys*, p. 214

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58. Palpal seg. 4 with a short, sharply-pointed tooth on the medial side at the distal end, leg IV of ♂ not modified ....*Huitfeldtia*, p. 213

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59. Palpus as long or longer than the body, ♂ with a petiole and without a modified leg segment ....*Hydrochoreutes*, p. 216

    Palpus not as long as the body 60

60. Leg I with a very large seg. 6, convex on the flexor surface, and a very large double claw ....*Wettina*, p. 216

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61. Genital plates of ♀ irregularly triangular with the latero-posterior angle produced, ♂ with leg segs. IV4 and IV6 modified ....*Pionacercus*, p. 218

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63. Leg seg. IV4 of ♂ greatly broadened and flattened, without a sabre-like spine *Laminipes*, p. 217

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64. Leg segs. I5 and I6 modified 65

    Leg segs. I5 and I6 normal 66

65. Palpal seg. 3 with fine teeth, ep. IV quadrilateral ....*Mesobates*, p. 219

    Palpal seg. 3 without teeth, ep. IV triangular ....*Atractides*, p. 219

66. Epimeron IV longer than broad, almost rectangular ......*Capobates*, p. 218

    Epimeron IV broader than long with shorter medial margin.*Hygrobates*, p. 219

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VIII. EXPLANATION OF PLATES

The figures contained in the following plates are, so far as they go and as near as may be, exact copies of those of the author from whom they were taken. For the larger part of them—134 individual figures out of 165—I am much indebted to Mr. S. Fred Prince, of the Department of Biology in the State Normal at Warrensburg, Mo. Acknowledgments are also extended, for each, to the original author.

PLATE XVIII

Fig. 1. Larva of *Hydrachna inermis* Piersig. Ventral surface. × 70. Modified from Piersig, 1897, Pl. XLII, figs. 124b and 124c, reduced.

Fig. 2. Larva of *Limnochares aquaticus* (Linnaeus). Ventral surface. × 176. Piersig, 1897, Pl. XLIV, fig. 129m, reduced.

Fig. 3. Larva of *Diplodontus despiciens* (Müller). Ventral surface. × 133. Piersig, 1897, Pl. XLI, fig. 118e, reduced.

Fig. 4. Larva of *Eylais extendens* (Müller). Ventral surface. × 67. Piersig, 1897, Pl. XLI, fig. 119c, reduced.

Fig. 5. Larva of *Arrhenurus maximus* Piersig. Ventral surface. × 133. Piersig, 1897, Pl. XXXIV, fig. 87g, reduced.

Fig. 6. Larva of *Mideopsis orbicularis* (Müller). Ventral surface. × 75. From Piersig, 1897, Pl. XXVI, fig. 67g, reduced.

Fig. 7. Larva of *Brachypoda versicolor* (Müller). Ventral surface. × 93. From Piersig, 1897, Pl. XXV, fig. 64l, reduced.

Fig. 8. Larva of *Limnesia koenikei* Piersig. Ventral surface. × 105. From Piersig, 1897, Pl. XXII, fig. 56h, reduced.

Fig. 9. Larva of *Lebertia tau-insignita* (Lebert), according to Piersig. Ventral surface. × 85. From Piersig, 1897, Pl. XX, fig. 51g, reduced.

Fig. 10. Larva of *Piona carnea* (Koch). Ventral surface. × 67. From Piersig, 1897, Pl. XI, fig. 29h, reduced.

Fig. 11. Larva of *Hygrobates longipalpis* (Hermann). Ventral surface. × 76. Piersig, 1897, Pl. XIX, fig. 47k, reduced.

PLATE XVIII

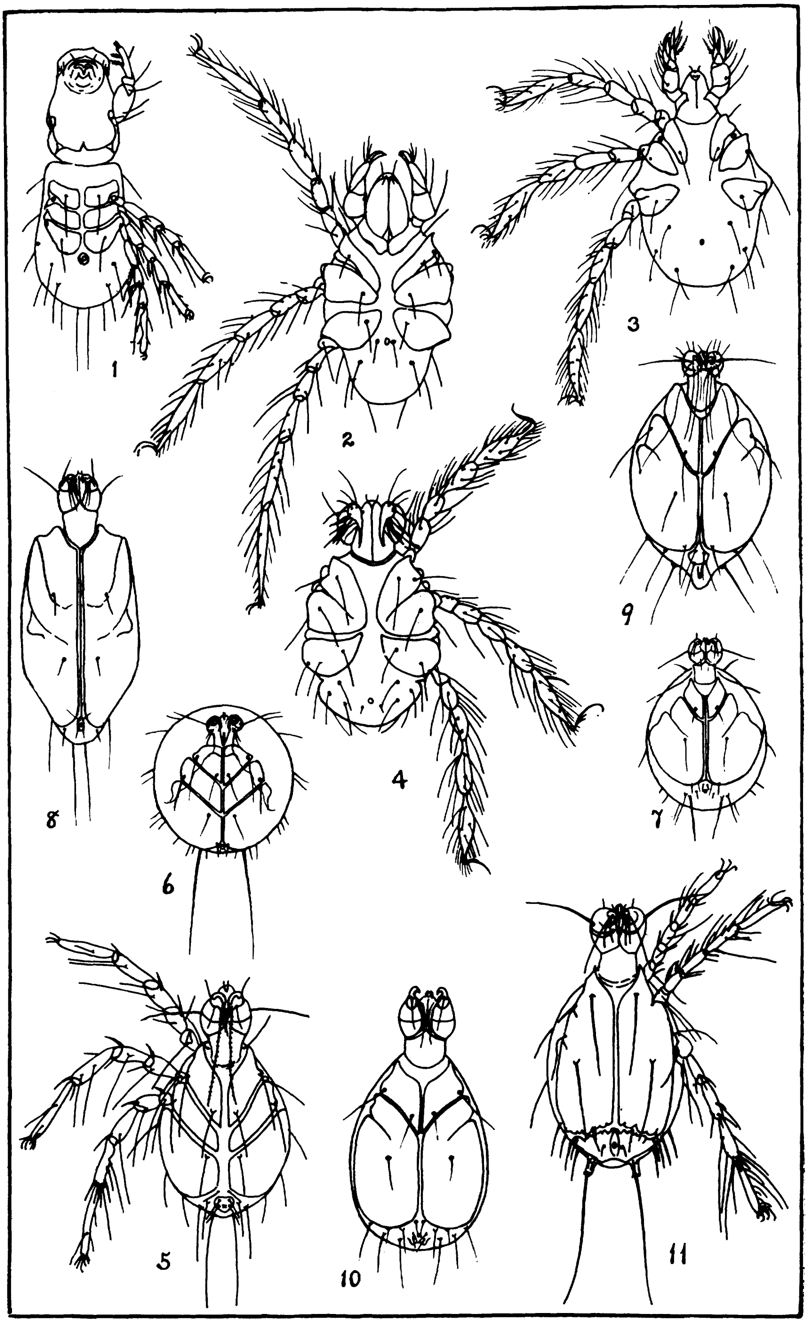

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PLATE XIX

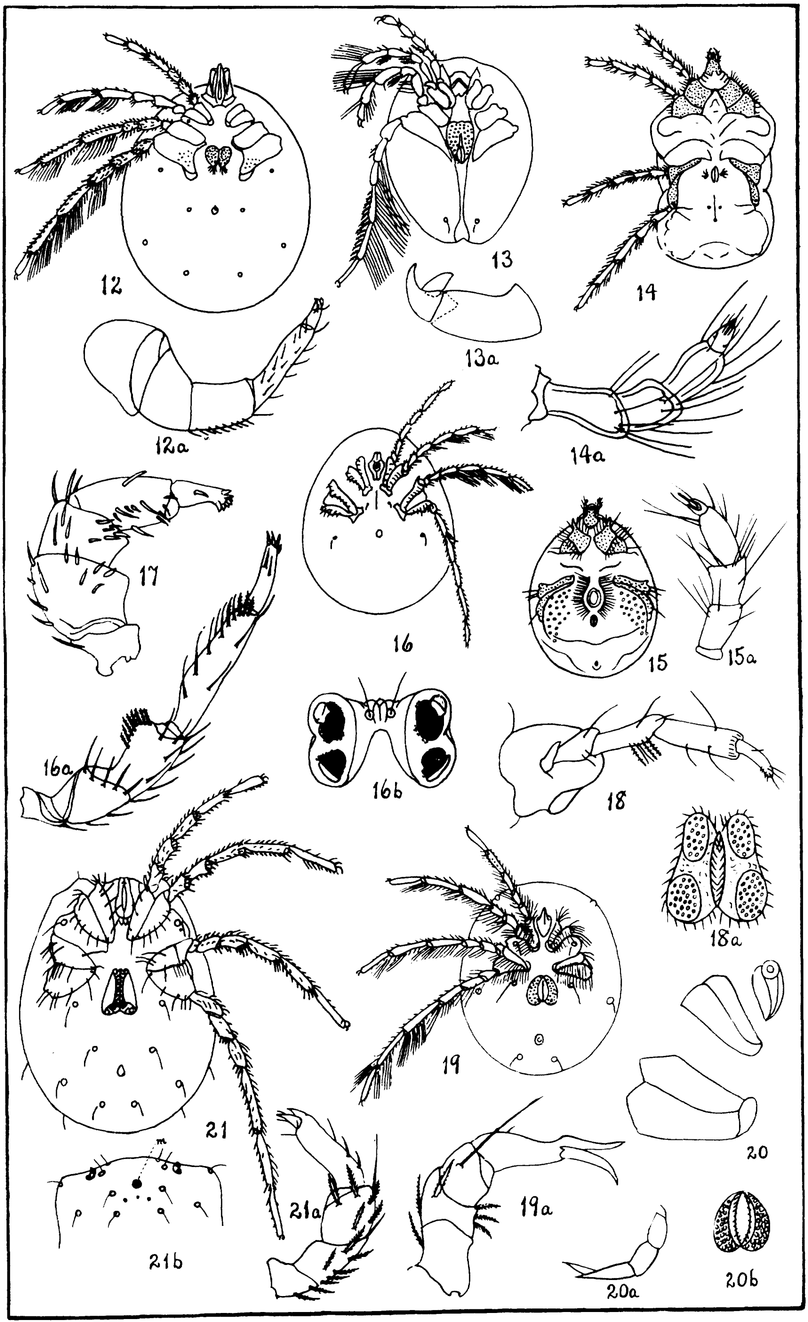

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PLATE XIX

Fig. 12. *Hydrachna geographica* Müller. Ventral surface, ♀. × 4. Piersig, 1897, Pl. XLII, fig. 122b, reduced.

Fig. 12a. *Hydrachna geographica* Müller. Palpus, ♀. × 16. From Piersig, 1897, Pl. XLII, fig. 122c, reduced.

Fig. 13. *Bargena mirifica* Koenike. Ventral surface, ♂. × 24. Modified from Koenike, 1893, Pl. III, fig. 35, reduced.

Fig. 13a. *Bargena mirifica* Koenike. Segs. 3, 4, 5 of right palpus, ♂. × 150. Koenike, 1893, Pl. III, fig. 40, reduced.

Fig. 14. *Limnochares aquaticus* (Linnaeus). Ventral surface, ♀. × 9. Piersig, 1897, Pl. XLIV, fig. 129a, reduced.

Fig. 14a. *Limnochares aquaticus* (Linnaeus). Right palpus. × 95. Piersig, 1897, Pl. XLIV, fig. 129e, reduced.

Fig. 15. *Cyclothrix crinita* (Koenike). Ventral surface, ♂. × 13. Koenike, 1898b, Pl. XXI, fig. 23, reduced.

Fig. 15a. *Cyclothrix crinita* (Koenike). Right palpus. × 130. Koenike, 1898b, Pl. XXI, fig. 26, reduced (figure reversed).

Fig. 16. *Eylais extendens* (Müller). Ventral surface, ♀. × 7. From Piersig, 1897, Pl. XLI, fig. 119a, reduced.

Fig. 16a. *Eylais extendens* (Müller). Palpus, inner side. × 69. Piersig, 1897, Pl. XLVIII, fig. 119e, reduced.

Fig. 16b. *Eylais extendens* (Müller). Eye-plate. × 59. Piersig, 1897, Pl. XLVIII, fig. 119g, reduced.

Fig. 17. *Capeulais crassipalpis* Thor. Palpus, inner side. Thor, 1902, Pl. XVIII, fig. 20, reduced.

Fig. 18. *Piersigia limophila* Protz. Capitulum and palpus. Protz, 1896b, fig. 9, slightly reduced.

Fig. 18a. *Piersigia limophila* Protz. Genital area. After Protz, 1896b, fig. 8, slightly enlarged.

Fig. 19. *Diplodontus despiciens* (Müller). Ventral surface, ♂. × 15. From Piersig, 1897, Pl. XLI, fig. 118a, reduced.

Fig. 19a. *Diplodontus despiciens* (Müller). Palpus, outer side, ♀. × 103. From Piersig, 1897, Pl. XLI, fig. 118d, reduced.

Fig. 20. *Oxopsis diplodontoides* Nordenskiöld. Epimeral area, one side, and capitulum. Nordenskiöld, 1905, fig. 1e, reduced.

Fig. 20a. *Oxopsis diplodontoides* Nordenskiöld. Palpus. Nordenskiöld, 1905, fig. 1c, reduced.

Fig. 20b. *Oxopsis diplodontoides* Nordenskiöld. Genital area. Nordenskiöld, 1905, fig. 1f, reduced.

Fig. 21. *Thyas venusta* Koch. Ventral surface, ♀. × 16. From Piersig, 1897, Pl. XLIII, fig. 127a, reduced.

Fig. 21a. *Thyas venusta* Koch. Palpus, outer side, ♂. × 65. From Piersig, 1897, Pl. XLIII, fig. 127g, reduced.

Fig. 21b. *Thyas venusta* Koch. Anterior portion of dorsal surface, ♀, showing median eye (*m*). × 16. From Piersig, 1897, Pl. XLIII, fig. 127b, reduced.

PLATE XX

Fig. 22. *Panisus cataphractus* Koenike. Epimeral area, maxillary shield and genital area. × 43. Koenike, 1895b, Pl. II, fig. 34, reduced.

Fig. 22a. *Panisus cataphractus* Koenike. Left palpus. × 93. Koenike, 1895b, Pl. II, fig. 35, reduced.

Fig. 23. *Thyopsis cancellata* (Protz). Ventral surface, ♀. × 25. From Piersig, 1897, Pl. XLIX, fig. 159b, reduced.

Fig. 23a. *Thyopsis cancellata* (Protz). Palpus. Piersig, 1897, XLIX, fig. 159c, reduced.

Fig. 24. *Panisus trabecula* (Thor). Dorsal surface. Thor, 1899. Pl. VI, fig. 61, reduced.

Fig. 25. *Partnunia angusta* (Koenike). Ventral surface. × 23. From Piersig, 1897, Pl. LI, fig. 196a, reduced.

Fig. 25a. *Partnunia angusta* (Koenike). Palpus, outer side. × 87. From Piersig, 1897, Pl. LI, fig. 196b, reduced.

Fig. 26. *Protzia eximia* (Protz). Ventral surface, ♀. × 27. Piersig, 1897, Pl. XLV, fig. 143, reduced.

Fig. 27. *Sporadoporus invalvaris* (Piersig). Ventral surface, ♀. × 31. From Piersig, 1897, Pl. XLV, fig. 137a, reduced.

Fig. 27a. *Sporadoporus invalvaris* (Piersig). Palpus. × 123. Piersig, 1897, Pl. XLV, fig. 137b, reduced.

Fig. 28. *Hydryphantes ruber* (de Geer). Ventral surface, ♀. × 17. From Piersig, 1897, Pl. XLIV, fig. 130a, reduced.

Fig. 28a. *Hydryphantes ruber* (de Geer). Outer side, left palpus, ♀. × 42. From Piersig, 1897, Pl. XLIV, fig. 130d, reduced.

Fig. 29. *Eupatra scapularis* (Dugès). Ventral surface, ♂. × 15. From Piersig, 1897, Pl. XLV, fig. 138a, reduced.

Fig. 29a. *Eupatra scapularis* (Dugès). Palpus, ♂. × 69. Piersig, 1897, Pl. XLV, fig. 138d, reduced.

Fig. 30. *Mamersa testudinata* Koenike. Ventral surface, ♀. × 26. Modified from Koenike, 1898b, Pl. XXIII, figs. 80, 81, reduced.

Fig. 30a. *Mamersa testudinata* Koenike. Palpus, ♀. × 120. From Koenike, 1898b, Pl. XXIII, fig. 84, reduced.

PLATE XX

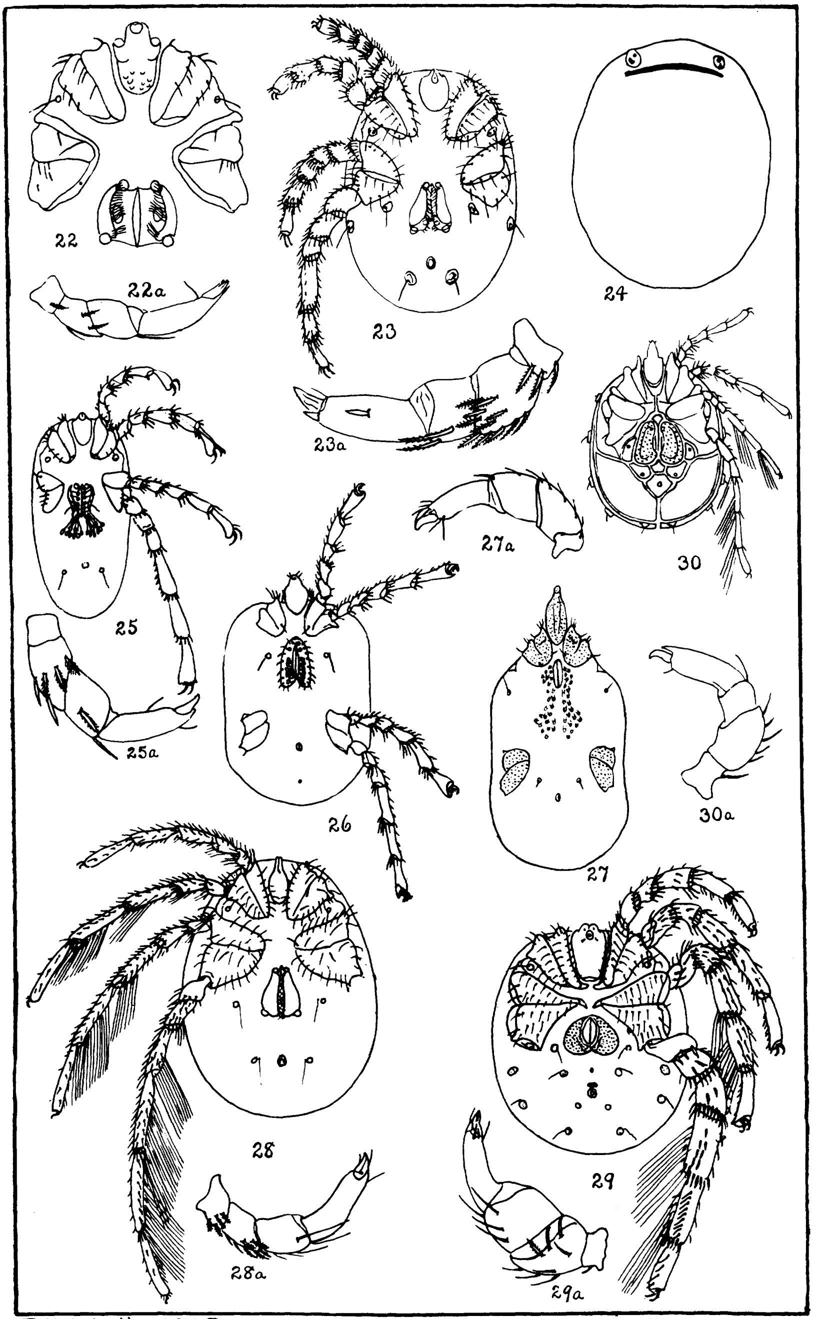

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PLATE XXI

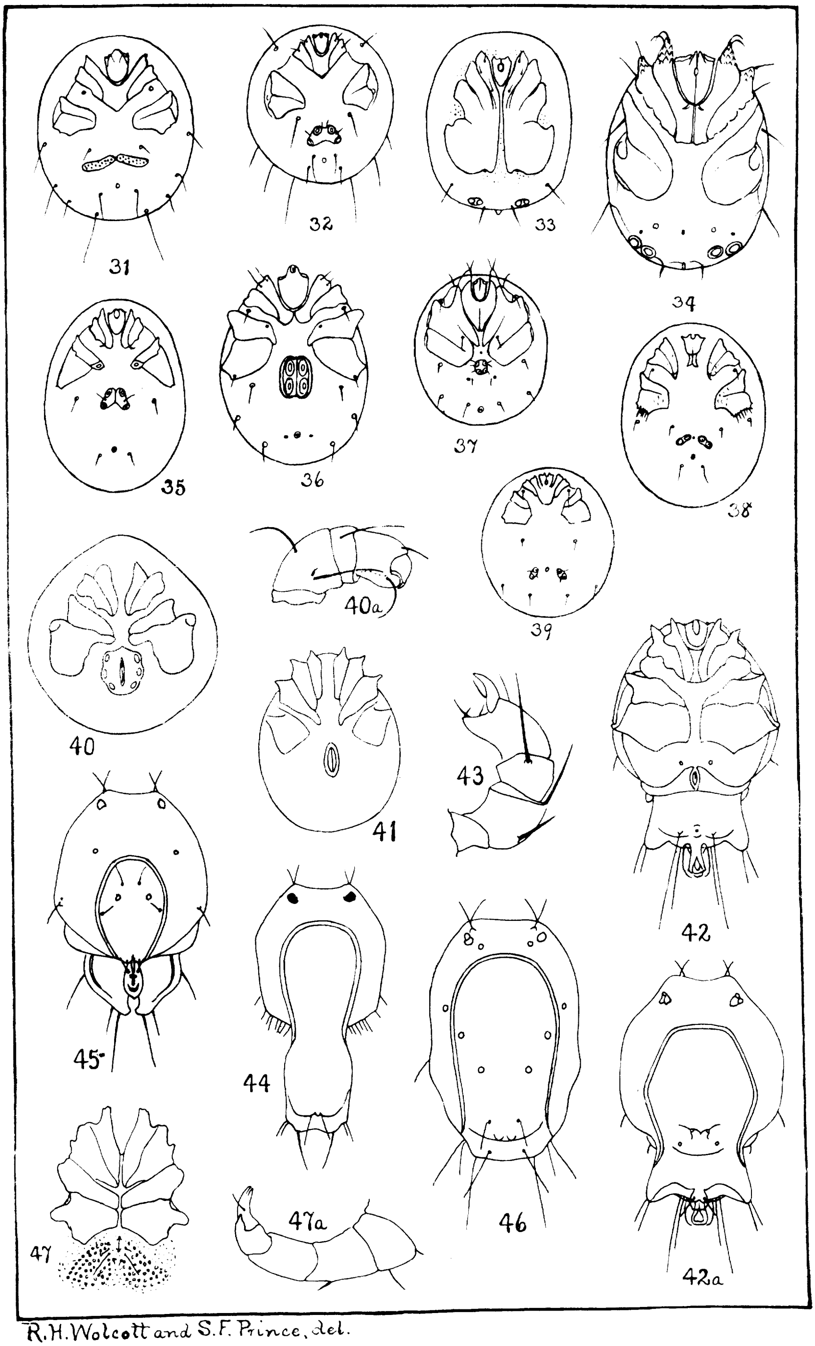

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PLATE XXI

Fig. 31. Nymph of *Arrhenurus maculator* (Müller). Ventral surface. × 37. From Piersig, 1897, Pl. XXXV, fig. 90e, reduced.

Fig. 32. Nymph of *Mideopsis orbicularis* (Müller). Ventral surface. × 41. From Piersig, 1897, Pl. XXVI, fig. 67d, reduced.

Fig. 33. Nymph of *Brachypoda versicolor* (Müller). Ventral surface. × 53. From Piersig, 1897, Pl. XXV, fig. 64i, reduced.

Fig. 34. Nymph of *Aturus scaber* Kramer. Ventral surface. × 99. From Piersig, 1897, Pl. XL, fig. 117a, reduced.

Fig. 35. Nymph of *Limnesia koenikei* Piersig. Ventral surface. × 36. From Piersig, 1897, Pl. XXII, fig. 56g, reduced.

Fig. 36. Nymph of *Sperchon glandulosus* Koenike. Ventral surface. × 60. From Piersig, 1897, Pl. XXI, fig. 54d, reduced.

Fig. 37. Nymph of *Lebertia tau-insignita* (Lebert), according to Piersig. Ventral surface. × 40. From Piersig, 1897, Pl. XX, fig. 51f, reduced.

Fig. 38. Nymph of *Piona longipalpis* (Krendowskij). Ventral surface. × 21. Piersig, 1897, Pl. XIII, fig. 33e, reduced.

Fig. 39. Nymph of *Hygrobates longipalpis* (Hermann). Ventral surface. × 33. From Piersig, 1897, Pl. XIX, fig. 47g, reduced.

Fig. 40. *Krendowskija latissima* Piersig. Ventral surface, ♀. Piersig, 1901a, fig. 16, reduced (copied from Krendowskij).

Fig. 40a. *Krendowskija ovata* Wolcott. Inner side, palpus, ♀. × 118. Wolcott, 1900, Pl. IX, fig. 6, reduced.

Fig. 41. *Arrhenurella convexa* Ribaga. Ventral surface. Ribaga, 1903, Pl. II, fig. 42, much reduced.

Fig. 42. *Arrhenurus maculator* (Müller). Ventral surface, ♂. × 30. Piersig, 1897, Pl. XXXV, fig. 90c, reduced.

Fig. 42a. *Arrhenurus maculator* (Müller). Dorsal surface, ♂. × 30. Piersig, 1897, Pl. XXXV, fig. 90f, reduced.

Fig. 43. *Arrhenurus albator* (Müller). Outer side, palpus, ♂. × 113. From Piersig, 1897, Pl. XXXI, fig. 79e, reduced.

Fig. 44. *Arrhenurus globator* (Müller). Dorsal surface, ♂. × 39. From Piersig, 1897, Pl. XXVIII, fig. 72f, reduced.

Fig. 45. *Arrhenurus forpicatus* Neuman. Dorsal surface, ♂. × 27. From Piersig, 1897, Pl. XXXVII, fig. 98b, reduced.

Fig. 46. *Arrhenurus truncatellus* (Müller). Dorsal surface, ♂. × 35. Piersig, 1897, Pl. XL, fig. 111b, reduced.

Fig. 47. *Tanaognathus spinipes* Wolcott. Epimeral field and genital area, ♂. × 42. Wolcott, 1900, Pl. XII, fig. 26, much reduced.

Fig. 47a. *Tanaognathus spinipes* Wolcott. Outer side, palpus, ♂. × 195. Wolcott, 1900, Pl. XI, fig. 22, much reduced.

PLATE XXII

Fig. 48. *Koenikea concava* Wolcott. Epimeral field and genital area, ♂. × 65. Wolcott, 1900, Pl. XII, fig. 24, much reduced.

Fig. 48a. *Koenikea concava* Wolcott. Inner side, palpus, ♂. × 278. Wolcott, 1900, Pl. XI, fig. 19, much reduced.

Fig. 48b. *Koenikea concava* Wolcott. Side view, capitulum and rostrum, ♀. × 277. Wolcott, 1900, Pl. XI, fig. 18, reduced.

Fig. 49. *Mamersopsis thoracica* Nordenskiöld. Ventral surface. Nordenskiöld, 1905, fig. 4b, reduced.

Fig. 50. *Torrenticola anomala* (Koch). Ventral surface, ♀. × 27. From Piersig, 1897, Pl. XXVII, fig. 69a, reduced.

Fig. 50a. *Torrenticola anomala* (Koch). Outer side, palpus, ♀. × 110. From Piersig, 1897, Pl. XXVII, fig. 69d, reduced.

Fig. 51. *Amasis niloticus* Nordenskiöld. Ventral surface. Nordenskiöld, 1905, fig. 5b, reduced.

Fig. 52. *Mideopsis orbicularis* (Müller). Ventral surface, ♀. × 23. From Piersig, 1897, Pl. XXVI, fig. 67a, reduced.

Fig. 52a. *Mideopsis orbicularis* (Müller). Outer side, palpus. × 123. From Piersig, 1897, Pl. XXVI, fig. 67c, reduced.

Fig. 53. *Xystonotus asper* Wolcott. Ventral surface, ♀. × 43. From Wolcott, 1900, Pl. X, fig. 12, much reduced.

Fig. 53a. *Xystonotus asper* Wolcott. Outer side, palpus, ♀. × 195. Wolcott, 1900, Pl. X, fig. 11, much reduced.

Fig. 54. *Midea elliptica* (Müller). Ventral surface, ♀. × 28. From Piersig, 1897, Pl. XXVI, fig. 66a, reduced.

Fig. 54a. *Midea elliptica* (Müller). Outer side, palpus, ♀. × 125. From Piersig, 1897, Pl. XXVI, fig. 66d, reduced.

Fig. 54b. *Midea elliptica* (Müller). Genital area, ♂. × 72. Piersig, 1897, Pl. XXVI, fig. 66e, reduced.

Fig. 54c. *Midea elliptica* (Müller). Dorsal surface, ♂, showing suture. × 32. From Piersig, 1897, Pl. XXVI, fig. 66c, reduced.

Fig. 55. *Brachypoda versicolor* (Müller). Ventral surface, ♀. × 50. From Piersig, 1897, Pl. XXV, fig. 64a, reduced.

Fig. 55a. *Brachypoda versicolor* (Müller). Ventral surface, ♂. × 46. From Piersig, 1897, Pl. XXV, fig. 64b, reduced.

Fig. 55b. *Brachypoda versicolor* (Müller). Outer side, palpus, ♀. × 176. From Piersig, 1897, Pl. XXV, fig. 64e, reduced.

Fig. 55c. *Brachypoda versicolor* (Müller). Leg. IV, ♂. × 134. Piersig, 1897, Pl. XXV, fig. 64g, reduced.

Fig. 56. *Ljania bipapillata* Thor. Ventral surface. From Thor, 1899, Pl. X, fig. 98, much reduced.

Fig. 56a. *Ljania bipapillata* Thor. Palpus. Thor, 1899, Pl. X, fig. 100, reversed and reduced.

PLATE XXII

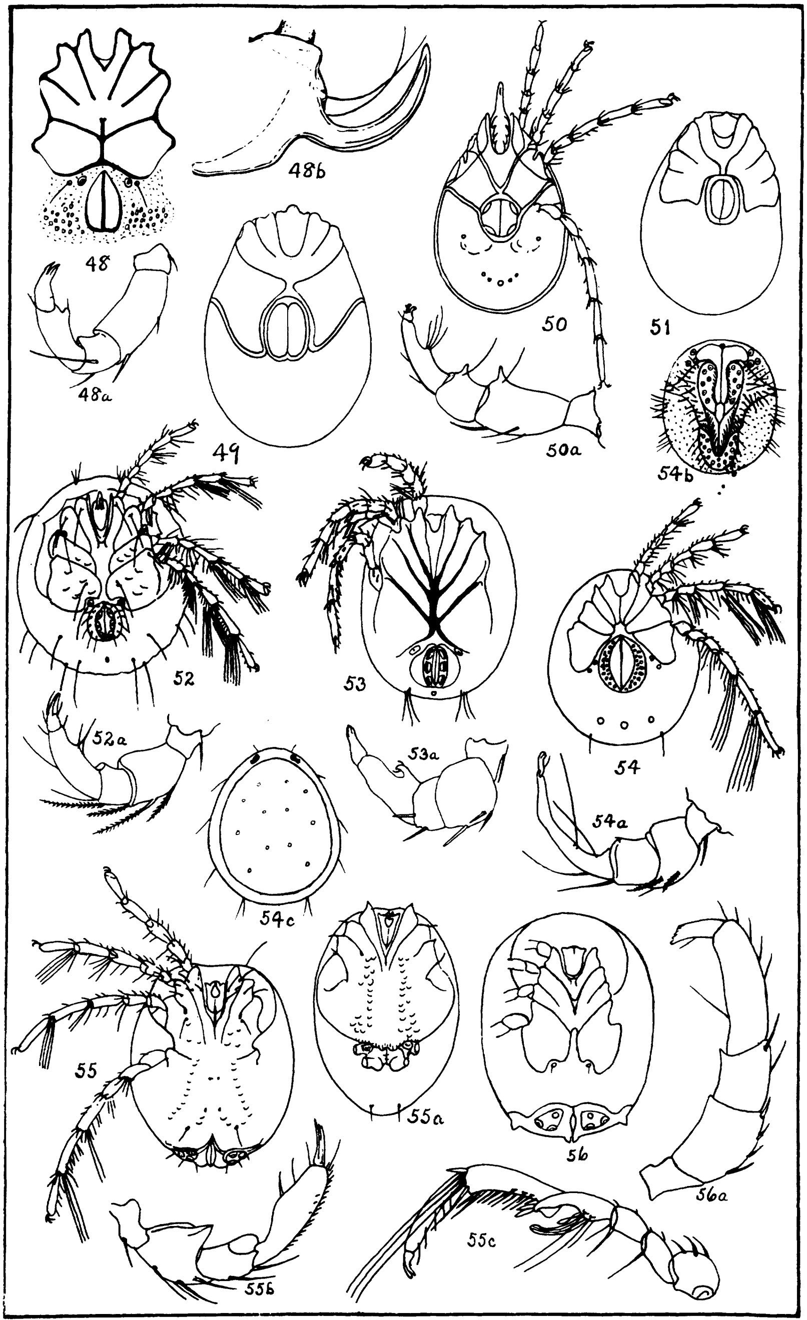

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PLATE XXIII

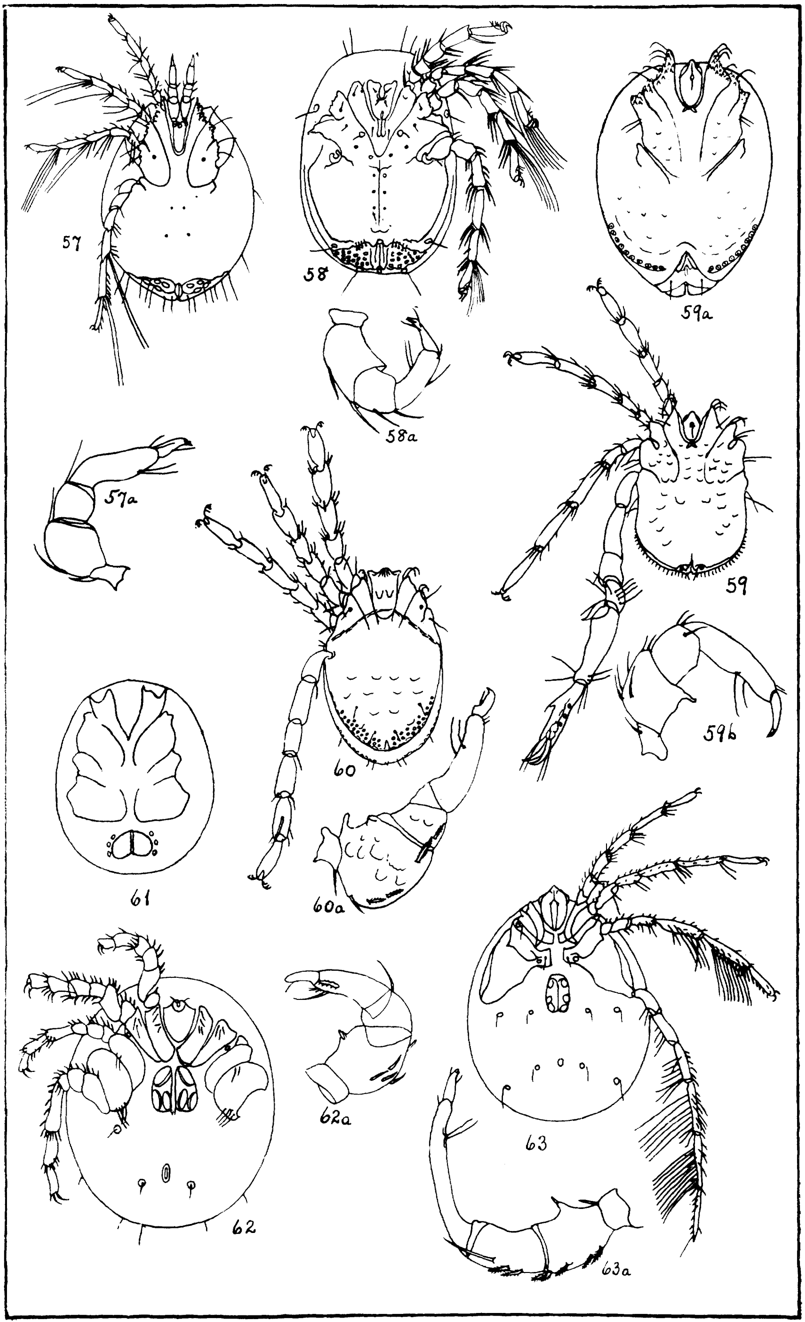

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PLATE XXIII

Fig. 57. *Axonopsis complanata* (Müller). Ventral surface, ♀. Piersig, 1893, fig. 1, reduced.

Fig. 57a. *Axonopsis complanata* (Müller). Outer side, palpus. × 123. Piersig, 1897, Pl. XXV, fig. 65c, reduced.

Fig. 58. *Albia stationis* Thon. Ventral surface, ♀. Thon, 1899a, Pl. I, fig. 2, much reduced.

Fig. 58a. *Albia stationis* Thon. Outer side, palpus, ♀. Thon, 1899a, Pl. I, fig. 3, much reduced.

Fig. 59. *Aturus scaber* Kramer. Ventral surface, ♂. × 61. From Piersig, 1897, Pl. XXVII, fig. 68b, reduced.

Fig. 59a. *Aturus scaber* Kramer. Ventral surface, ♀. × 67. From Piersig, 1897, Pl. XXVII, fig. 68a, reduced.

Fig. 59b. *Aturus scaber* Kramer. Outer side, palpus, ♀. × 150. From Piersig, 1897, Pl. XXVII, fig. 68e, reduced.

Fig. 60. *Hjartdalia runcinata* Thor. Ventral surface. From Piersig, 1901c, fig. 1, reduced, modified in accordance with Piersig, 1903, Pl. II, fig. 7.

Fig. 60a. *Hjartdalia runcinata* Thor. Palpus. From Piersig, 1901c, fig. 2, reduced.

Fig. 61. *Notomideopsis spinipes* (Nordenskiöld). Ventral surface. Nordenskiöld, 1904, fig. 3, reduced.

Fig. 62. *Tyrrellia circularis* Koenike. Ventral surface, ♀. × 26. From Koenike, 1895b, Pl. II, fig. 37, reduced.

Fig. 62a. *Tyrrellia circularis* Koenike. Palpus, ♀, inner side. × 49. Koenike, 1895b, Pl. II, fig. 36, reduced.

Fig. 63. *Limnesia histrionica* (Hermann). Ventral surface, ♀. × 16. From Piersig, 1897, Pl. XXIII, fig. 60a, reduced.

Fig. 63a. *Limnesia histrionica* (Hermann). Outer side, palpus, ♀. × 51. From Piersig, 1897, Pl. XXIII, fig. 60e, reduced.

PLATE XXIV

Fig. 64. *Limnesiopsis anomala* (Koenike). Epimeral field and genital area, ♂. × 25. Koenike, 1895b, Pl. II, fig. 50, reduced.

Fig. 64a. *Limnesiopsis anomala* (Koenike). Outer side, palpus, ♂. × 49. Koenike, 1895b, Pl. II, fig. 51, reduced.

Fig. 65. *Pseudosperchon verrucosus* (Protz). Ventral surface, ♀. × 24. Piersig, 1897, Pl. XX, fig. 53a, reduced.

Fig. 65a. *Pseudosperchon verrucosus* (Protz). Palpus, ♀. × 79. Piersig, 1897, Pl. XX, fig. 53b, reduced.

Fig. 66. *Hydrovolzia placophora* (Monti). Ventral surface, ♀. From Monti, 1905, Pl. II, fig. 2, much reduced.

Fig. 66a. *Hydrovolzia placophora* (Monti). Palpus, ♀. Thor, 1905, fig. 4, reduced.

Fig. 67. *Teutonia primaria* Koenike. Ventral surface, ♂. × 27. From Piersig, 1897, Pl. XXI, fig. 55a, reduced.

Fig. 67a. *Teutonia primaria* Koenike. Outer side, palpus, ♀. × 60. From Piersig, 1897, Pl. XXI, fig. 55c, reduced.

Fig. 68. *Sperchon glandulosus* Koenike. Ventral surface, ♀. × 24. From Piersig, 1897, Pl. XXI, fig. 54a, reduced.

Fig. 68a. *Sperchon glandulosus* Koenike. Outer side, palpus, ♀. × 94. From Piersig, 1897, Pl. XXI, fig. 54c, reduced.

Fig. 69. *Nilotonia loricata* (Nordenskiöld). Ventral surface, ♂. Nordenskiöld, 1905, fig. 6a, reduced.

Fig. 69a. *Nilotonia loricata* (Nordenskiöld). Outer side, palpus. From Nordenskiöld, 1905, fig. 6b, slightly enlarged.

Fig. 70. *Lebertia tau-insignita* (Lebert), according to Piersig, *L. dubia* Thor. Ventral surface, ♀. × 19. From Piersig, 1897, Pl. XX, fig. 51a, reduced.

Fig. 70a. *Lebertia tau-insignita* (Lebert), according to Piersig, *L. dubia* Thor. Outer side, palpus, ♀. × 70. From Piersig, 1897, Pl. XX, fig. 51c, reduced.

PLATE XXIV

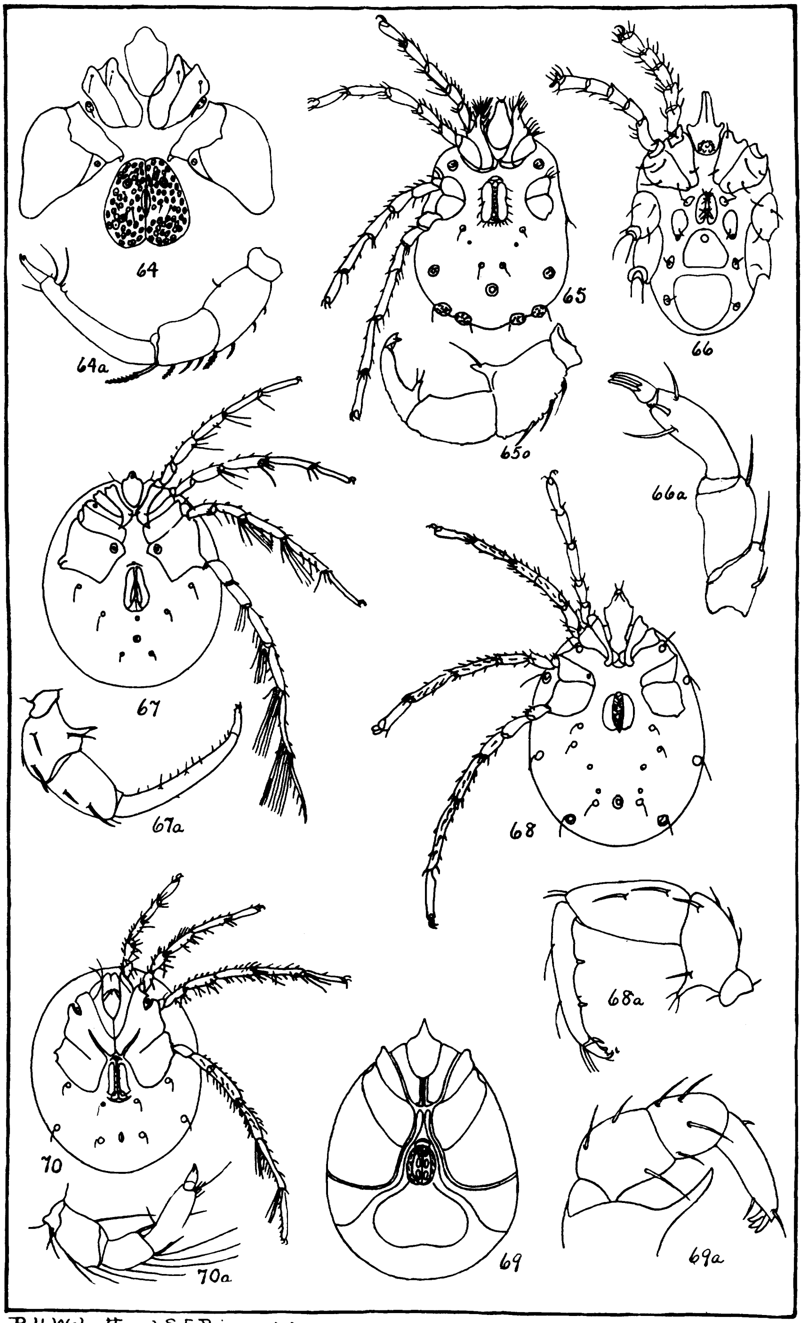

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PLATE XXV

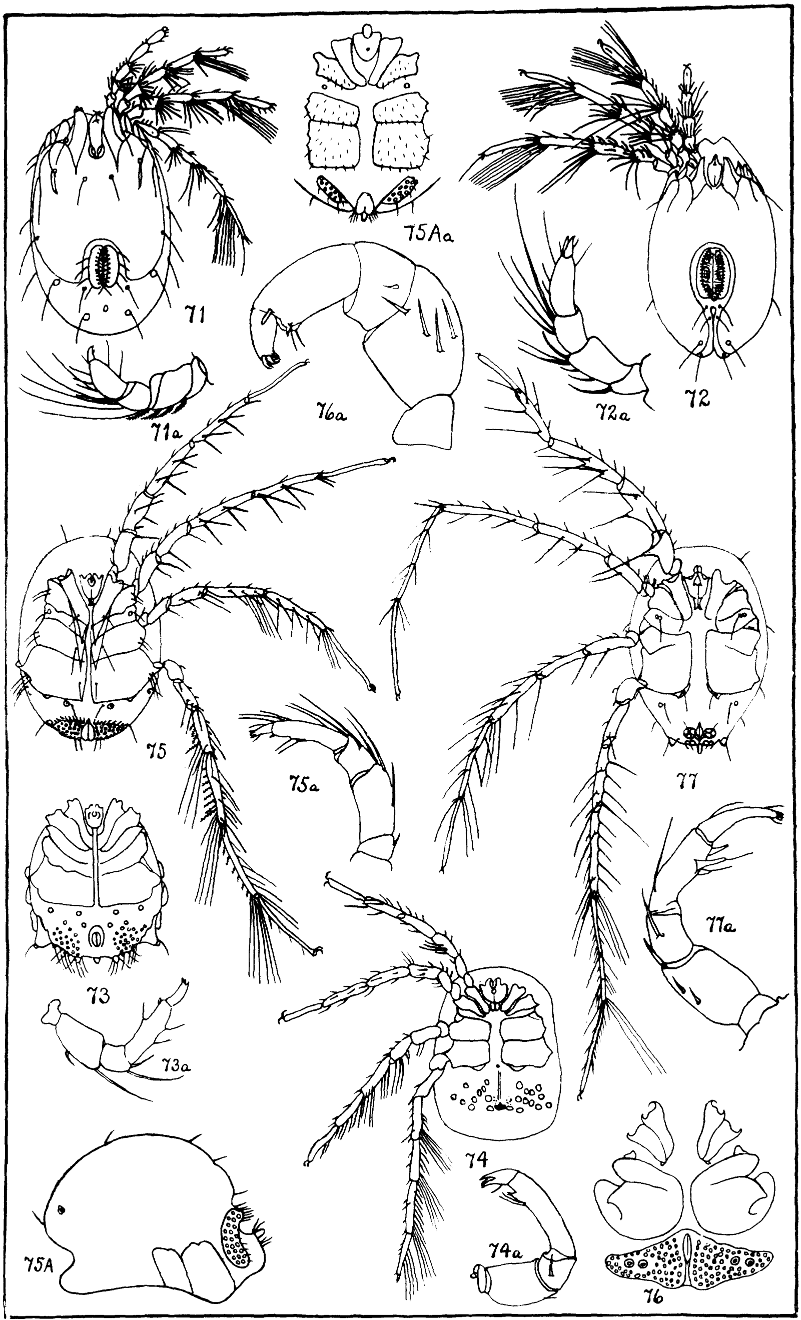

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PLATE XXV

Fig. 71. *Oxus ovalis* (Müller). Ventral surface, ♀. × 30. From Piersig, 1897, Pl. XXIV, fig. 61a, reduced.

Fig. 71a. *Oxus strigatus* (Müller). Palpus, ♀, outer side. × 90. From Piersig, 1897, Pl. XXIV, fig. 61d, reduced.

Fig. 72. *Frontipoda musculus* (Müller). Ventral surface, ♀. × 31. From Piersig, 1897, Pl. XXIV, fig. 62a, reduced.

Fig. 72a. *Frontipoda musculus* (Müller). Outer side, palpus, ♀. × 93. From Piersig, 1897, Pl. XXIV, fig. 62e, reduced.

Fig. 73. *Ecpolus tuberatus* Koenike. Ventral surface, ♂. × 42. Koenike, 1898b, Pl. XXIII, fig. 73, reduced.

Fig. 73a. *Ecpolus tuberatus* Koenike. Palpus, inner side, ♂. × 107. Koenike, 1898b, Pl. XXIII, fig. 74, reduced.

Fig. 74. *Encentridophorus spinifer* (Koenike). Ventral surface, ♀. × 30. From Koenike, 1893, Pl. II, fig. 16, reduced.

Fig. 74a. *Encentridophorus spinifer* (Koenike). Outer side, palpus, ♀. × 63. Koenike, 1893, Pl. II, fig. 17, reduced.

Fig. 75. *Neumania spinipes* (Müller). Ventral surface, ♂. × 40. From Piersig, 1897, Pl. V, fig. 8a, reduced.

Fig. 75a. *Neumania spinipes* (Müller). Outer side, palpus, ♂. × 70. From Piersig, 1897, Pl. V, fig. 8e, reduced.

Fig. 75A. *Dadaya multipora* (Daday). Body, from lateral aspect. From Daday, 1901, fig. 24c.

Fig. 75Aa. *Dadaya multipora* (Daday). Epimeral field and genital area. Daday, 1901, fig. 24b.

Fig. 76. *Najadicola ingens* (Koenike). Epimeral field and genital area, ♂. × 23. Koenike, 1895b, fig. 66, reduced.

Fig. 76a. *Najadicola ingens* (Koenike). Inner side, palpus, ♂. × 80. Wolcott, 1899, Pl. XXXII, fig. 39, much reduced.

Fig. 77. *Unionicola crassipes* (Müller). Ventral surface, ♀. × 22. From Piersig, 1897, Pl. III, fig. 5a, reduced.

Fig. 77a. *Unionicola crassipes* (Müller). Palpus, outer side, ♀. × 63. From Piersig, 1897, Plate III, fig. 5d, reduced.

PLATE XXVI

Fig. 78. *Hydrochoreutes ungulatus* (Koch). Ventral surface, ♂. × 36. From Piersig, 1897, Pl. VII, fig. 9g, reduced.

Fig. 78a. *Hydrochoreutes ungulatus* (Koch). Outer side, palpus, ♀. × 70. From Piersig, 1897, Pl. VI, fig. 9e, reduced.

Fig. 79. *Pionopsis lutescens* (Hermann). Ventral surface, ♂. × 50. From Piersig, 1897, Pl. XV, fig. 39c, reduced.

Fig. 79a. *Pionopsis lutescens* (Hermann). Outer side, palpus, ♀. × 67. From Piersig, 1897, Pl. XV, fig. 39e, reduced.

Fig. 80. *Pionides ensifer* (Koenike). Ventral surface, ♂. × 37. From Piersig, 1897, Pl. XVIII, fig. 46a, reduced.

Fig. 80a. *Pionides ensifer* (Koenike). Outer side, palpus, ♂. × 113. From Piersig, 1897, Pl. XVIII, fig. 46b, reduced.

Fig. 80b. *Laminipes latipes* (Müller). Leg IV of ♂. × 27. From Piersig, 1897, Pl. XVII, fig. 42b, reduced.

Fig. 81. *Pionacercus leuckarti* Piersig. Ventral surface, ♂. × 27. From Piersig, 1897, Pl. XVII, fig. 43b, reduced.

Fig. 81a. *Pionacercus leuckarti* Piersig. Outer side, palpus, ♂. × 97. From Piersig, 1897, Pl. XVII, fig. 43d, reduced.

Fig. 82. *Pseudofeltria scourfieldi* Soar. Ventral surface, ♀. From Soar, 1904, fig. 1, reduced.

Fig. 83. *Feltria minuta* Koenike. Ventral surface, ♀. × 59. From Koenike, 1892a, fig. 3, reduced.

Fig. 83a. *Feltria rubra* Piersig. Palpus. × 140. Piersig, 1897, Pl. LI, fig. 197c, reduced.

PLATE XXVI

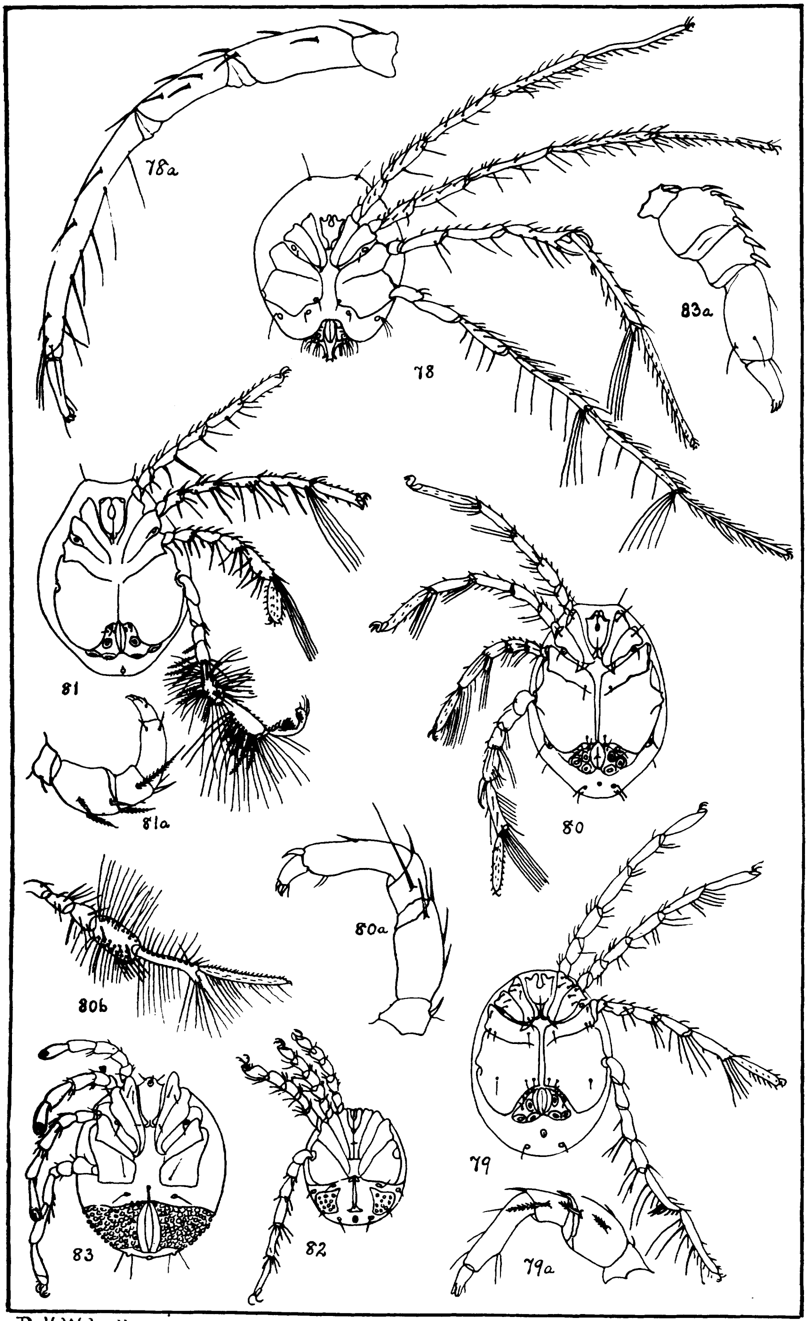

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PLATE XXVII

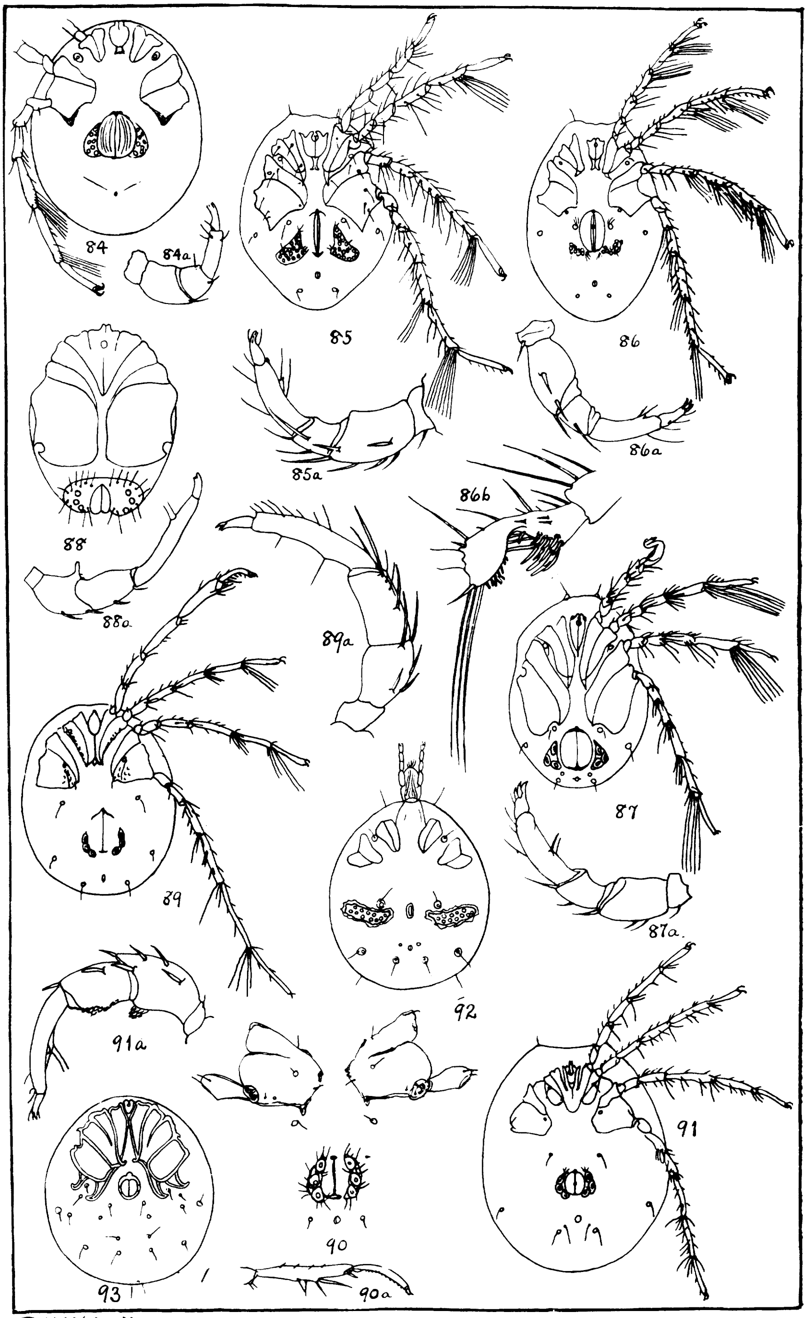

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PLATE XXVII

Fig. 84. *Huitfeldtia rectipes* Thor. Ventral surface, ♀. × about 22. From Thor, 1898b, Pl. V, fig. 1, much reduced.

Fig. 84a. *Huitfeldtia rectipes* Thor. Palpus, ♂. × about 71. From Thor, 1898b, Pl. V, fig. 6, much reduced.

Fig 85. *Tiphys liliaceus* (Müller). Ventral surface, ♀. × 28. From Piersig, 1897, Pl. VIII, fig. 15a, reduced.

Fig. 85a. *Tiphys liliaceus* (Müller). Outer side, palpus, ♀. × 123. From Piersig, 1897, Pl. VIII, fig. 15f, reduced.

Fig. 86. *Piona rufa* Koch. Ventral surface, ♀. × 22. From Piersig, 1897, Pl. XIV, fig. 37a, reduced.

Fig. 86a. *Piona rufa* Koch. Outer side, palpus, ♀. × 77. From Piersig, 1897, Pl. XIV, fig. 37e, reduced.

Fig. 86b. *Piona constricta* (Wolcott). Leg seg. IV4, ♂. × 107. From Wolcott, 1902, Pl. XXIX, fig. 16, reduced.

Fig. 87. *Wettina macroplica* Piersig. Ventral surface, ♀. × 33. From Piersig, 1897, Pl. XVIII, fig. 44a, reduced.

Fig. 87a. *Wettina macroplica* Piersig. Outer side, palpus, ♀. × 97. From Piersig, 1897, Pl. XVIII, fig. 44c, reduced.

Fig. 88. *Capobates sarsi* Thor. Ventral surface, ♂. × about 33. From Thor, 1898a, Pl. IV, fig. 1, reduced.

Fig. 88a. *Capobates sarsi* Thor. Palpus, ♂. × about 53. Thor, 1898a, Pl. IV, fig. 5, greatly reduced.

Fig. 89. *Atractides spinipes* Koch. Ventral surface, ♀. × 25. From Piersig, 1897, Pl. XVIII, fig. 45a, reduced.

Fig. 89a. *Atractides spinipes* (Koch). Outer side, palpus ,♀. × 103. From Piersig, 1897, Pl. XVIII, fig. 45c, reduced.

Fig. 90. *Mesobates forcipatus* Thor. Epp. III and IV and genital area, ♀. Thor, 1901a, fig. 8, reduced.

Fig. 90a. *Mesobates forcipatus* Thor. Leg segs. I5 and I6, ♀. × 22. From Thor, 1901a, fig. 9a, reduced.

Fig. 91. *Hygrobates longipalpis* (Hermann). Ventral surface, ♀. × 13. From Piersig, 1897, Pl. XIX, fig. 47a, reduced.

Fig. 91a. *Hygrobates longipalpis* (Hermann). Outer side, palpus, ♀. × 125. From Piersig, 1897, Pl. XIX, fig. 47e, reduced.

Fig. 92. *Nautarachna asperrima* Moniez. Ventral surface of nymph. Piersig, 1901a, fig. 75, reduced.

Fig. 93. *Pontarachna punctulum* Philippi. Ventral surface, ♀. Piersig, 1901a, fig. 76, reduced.

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